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Importance of Clean Metal

A very great number of factors can result in dirty or unsound castings, and some of these often escape the attention of the managers of both large and small foundries. Primarily, much can be done in the control of raw materials entering a furnace, such as for instance, elimination of broken-up castings from chemical works contaminated with really excessive quantities of sulphur, or, in the non-ferrous foundry, a bar on the use of " gypsied "-up scrap. Any effort towards cleanliness pays dividends, and here again we fail to see why over-metal should be poured into sand, instead of being cast into properly prepared chill moulds. Some foundries even shotblast all runners and heads before recharging into furnaces.

Many good systems are available for separating slag from metal at furnace spouts. When molten metal is taken from a furnace, it is worthy of being received in a clean ladle or shank, as neglect in this matter has been known to cause dirty and defective castings. Much thought, too, has been devoted to ensuring that only clean metal leaves the ladle, the two outstanding cases being the adoption of bottom-pouring techniques and tea-pot ladle types. Sometimes however these methods—when temperature drop is associated with the pouring of thin-section castings—are not always thought to be practical.

Next comes the pouring of metal into moulds. Here, with some of the light alloys, great care has to be taken not to agitate the metal, as any turbulence induces the formation of alumina dross, and the Durville method of pouring comes into prominence to ensure a minimum of movement of the metal. For casting manganese-bronze, a gadget resembling the bottom-pouring ladle has been used with success. In the running and feeding of moulds, ingenious combinations of systems take care both of directional solidification and cleanliness of metal. The filtering of metal has also received much consideration over the years. The use of oil-sand cores for this purpose was only a partial solution as only too often they were insufficiently refractory to withstand the heat of the metal and later, at least some of the sand became incorporated. Ceramic filters should supersede these as they are still intact though, of course, not re-usable after breaking up the mould. Moreover, on a meticulous costing basis, they are probably no dearer than the oil-sand type and infinitely more effective. Filters of this type are extensively used in some parts of the world, and are finding an increasing popularity in this country.

Shaw Process Licensees' Conference

A whole day's conference of European licensees of the Shaw Process of precision casting was held on Tuesday of last week in London, at the premises of the Institute of Directors in Belgrave Square. Mr. Noel Shaw presided at the morning session and Mr. Clifford Shaw for the afternoon proceedings, the delegates being guests of Shaw Processes, Limited, for luncheon at mid-day. About 30 delegates and licensees attended, including representatives from France, Germany, and Sweden, a most helpful visitor being Mr. I. Lubalin of the Shaw Process Development Corporation, United States.

Following a welcome to the delegates by Mr. Noel Shaw, technical contributions on the following subject matter were presented: "Large-size Precision Iron Casting by Shaw Process" by Mr. O. Madono (Riken Piston Ring KK, Tokyo)—read in the Author's absence by Mr. Clifford Shaw; "Development of Semi-permanent Backings for Composite Moulds," by Mr. H. J. Marshall (Shaw Processes' Continental concessionaires); "First Results with Chamotte-backed Moulds," by Mr. G. P. Welch (Wolverhampton Die Casting Company, Limited), and "Setting-up a Shaw Process Foundry," by Mr. D B. Winter (Innsworth Metals, Limited, a member of the Dowty Group). The afternoon's programme took in a general discussion by Mr. Lubalin on the US economy as applied to his group of licensees' activities and his showing of and commentary on a film "Steel Castings for Guided Missiles at Auto Specialties Inc., St. Joseph, Michigan." Other technical contributions were made by Mr. L. F. Hayward (G.K.N. Group Research Laboratory) on "Quality Control" and by Mr. W. Ball (Precision Products (Cumberland), Limited) on the "History of the Process, leading to Present-day Methods." The proceedings concluded with a talk by Mr. P. A. M. Cooke (D. Napier & Son, Limited) on "Experiences in using the Argo-Vac Arc-melting and Vacuum-casting Furnace." A number of noteworthy castings were also exhibited by delegates and production methods commented upon. The whole conference was characterized by free and frank discussions which will doubtless accrue to the benefit of all who participated.

British Occupational Hygiene Society's Conference

The 11th conference of the British Occupational Hygiene Society is to be held at the Institute of Mechanical Engineers, Westminster, London, on November 4. It will be devoted to a discussion of the problems of heating and ventilation as they affect personnel working in arduous environments. Among the speakers will be Dr. T. Bedford, Medical Research Council, who will deal with the physiological aspects of heating and ventilation, and Dr. A. R. Lind of the National Coal Board, who will discuss problems raised by work in hot environments. Flight Lt. J. Billingham, from the RAF Institute of Aviation Medicine, will speak on the physiological requirements for the ventilation of modern military aircraft, and the engineering problems thus raised will be covered by Mr. D. J. Day of the Royal Aircraft Establishment. Speakers from the Royal Naval Physiological Laboratory will deal with the heating and ventilation of submarines. Non-members are eligible to attend this conference on payment of a registration fee, and full details can be obtained from Dr. D. Turner, the Associated Ethyl Company, Limited, Ellesmere Port, Cheshire.

Davy-United's Record Year

Difficulty experienced in competing with offers from continental countries is underlined by Mr. D. F. Campbell, chairman of Davy-United, Limited (formerly Davy & United Engineering Company, Limited), Sheffield makers of plant for steelworks, etc. In the past many millions of pounds' worth of machinery was supplied on deferred terms arranged with banks, who obtained cover from the Export Credits Guarantee Department on the principle that the customer was the borrower. Such loans were no longer being made and a prospective lending bank cannot obtain a guarantee to cover the financing of progress payments before shipment.

The financial structure of the company and many like it is not designed to finance large contracts during manufacture, but foreign companies, often with support from their Governments, frequently offer the group attractive contracts and want its machinery, but have no sterling available for immediate payment.

Nevertheless, Mr. Campbell continues, strenuous efforts are being made to secure heavy engineering contracts, not only in the UK, but in Canada, Mexico, Argentina, Spain, France, and Germany. As a result the order-book for 1961-62 is filling up and there were good prospects that it would be full before long. Similarly more contracts were being made abroad with a view to increasing the sale of rolls.

It is estimated that in order to take full advantage from the installation of modern plant, an annual expenditure of about £450,000 on capital account will be required for the next few years. This will be found from retained profits and depreciation provisions. Group profits, before tax, for the year ended March 31, 1959, were a record at £1,586,001 (£1,024,163). The dividend is raised to 30 (20) per cent.

Forthcoming Events

SEPTEMBER 18

Institute of British Foundrymen

Bristol and West of England branch:—"Production of Aluminium Castings," by J. Vickers, 7.30 p.m., at the Royal Hotel, Bristol.

SEPTEMBER 22

National Society of Master Patternmakers

"An Introduction to Patternmaking in Plastics," by H. G. C. King, 7 p.m., at the Charing Cross Hotel, London, W.C.2.

SEPTEMBER 23

Institute of British Foundrymen

Birmingham branch:—"Effect of Mould Material on the Cooling Rate and Physical Properties of Cast Metals" (report of sub-committee T.S. 46), presented by J. Hird, 7.15 p.m., at the James Watt Memorial Institute, Great Charles Street.

London branch:—Presidential Address followed by lecture and film display, "Development of an Automatic Mouldiog System," by P. Spear and R. D. Mills, 7 p.m., at the Constitutional Club, Northumberland Avenue, W.C.2.

SEPTEMBER 25

Institute of British Foundrymen

Falkirk section:—"Future of the Light Casting Industry in Falkirk," by R. L. Hunter, 7.30 p.m., at the Temperance Cafe, Lint Riggs.

SEPTEMBER 28

Institute of British Foundrymen

Australian branch:—"Application of X-rays and Radio-isotopes in the Solving of Casting Problems," by H. Beadle, 7.45 p.m., at the Defence Standards Laboratory.

Refractory Concrete in Foundries

By E. Hammond, B.Sc., Ph.D., A.R.I.C., M.Inst.F.*

Perhaps the most striking change in the use of refractories in the post-war years has been the increased applications of refractory and insulating concretes, which have given to the furnace and maintenance engineer the same facilities and advantages of monolithic concrete construction enjoyed up to comparatively recent times only by the civil engineer and the building industry. Recent developments have now made it possible to employ refractory concretes in furnace construction and the like to operate at temperatures up to 1,800 deg. C. The monolithic method of construction eliminates the innumerable joints of furnace brick-work which, of course, are often the "weak link" in a refractory structure since, apart from the unavoidable leaks, failures of units such as doors or arches may be due initially to displacement of one or two bricks.

The casting of refractories for use in foundries is of particular value when there is a shortage of skilled bricklayers, since there is no expensive cutting and fitting of the brickwork, and special shapes such as burner blocks, etc. can be easily cast into suitable moulds.

PROPERTIES

Refractory concretes consist essentially of a suitable refractory aggregate bonded by a hydraulic refractory cement. Until quite recently the only type of cement employed was high-alumina cement (*e.g.* Ciment Fondu), a grey cement made by fusing a mixture of bauxite and limestone in a reverberatory furnace. The unqualified term "refractory concrete" normally refers to a mixture of high-alumina cement and crushed good-quality alumino-silica firebrick. A mix of this type has a maximum service temperature limit of 1,300 to 1,350 deg. C. The demand for refractory concretes in many applications at higher operating temperatures resulted in the development of a pure white calcium aluminate cement (*e.g.* Secar 250) which, being made from exceptionally pure materials, contains negligible quantities of silica and iron oxides and is, consequently, much more refractory than the well-known high-alumina cement. Typical compositions of the two types of cement are given in Table 1. The grey high-alumina cement is also called, in this country, aluminous cement and, sometimes abroad, calcium aluminate cement, whilst the pure white calcium aluminate cement is often referred to as tricalcium penta-aluminate cement because its composition corresponds approximately to a compound $3CaO.5Al_2O_3$. This compound does not exist and the cement is, in fact, a mixture of calcium monoaluminate ($CaO.Al_2O_3$) and calcium dialuminate ($CaO.2Al_2O_3$). However, for the purpose of brevity and clarity the two cements will be referred to henceforwards as h.a. cement (high-alumina) and t.c.p.a. cement (tricalcium penta-aluminate) respectively.

TABLE 1.—*Typical Percentage Compositions of Cements.*

Percentage of	High-alumina cement (Ciment Fondu).	Pure tri-calcium penta-aluminate cement (Secar 250)
Al_2O_3	40.0	71.5
CaO	37.5	27.5
Fe_2O_3	9.0	< 1.0
FeO	7.0	
SiO_2	4.5	
TiO_2	2.0	

Although some of the properties of refractory concrete are naturally governed by the type of refractory aggregate employed, the main properties depend, of course, on the essential constituent—h.a. cement or t.c.p.a. cement. Refractory concretes made with either of these cements have the following properties:—

Chemical Stability at High Temperature

Both these cements are stable up to their melting-points and it is, of course, for this reason mainly that they have been used in refractory applications. Portland cements cannot be used at temperatures above about 250 deg. C., since, on heating, they chemically decompose with the liberation of free lime which augments the amounts already present at normal ambient temperatures. It is also interesting to note that the absence of free lime in h.a. and t.c.p.a. cements, coupled with the alumina gel structure of the cement bond, confers on the cements chemical resistance properties to dilute acids, etc., which may be found in flue gases, and this resistance increases at higher temperatures.

Strength Characteristics

Both cements are extremely rapid hardening and refractory concretes attain full cold strength at 24 hours, being then ready for most applications. The effect of temperature on the strength[1] of perhaps the most commonly used mix (h.a. cement/crushed firebrick) is illustrated in Fig. 1. The cold strength is partially lost as the temperature increases due to the dehydration of the hydraulic bond. At temperatures of approximately 1,100 deg. C. and over a ceramic bond is formed which increases both with

* Dr. Hammond is on the staff of Lafarge Aluminous Cement Company, Limited.

time and temperature, and a fired strength is obtained which may be even greater than the original high cold strength. This type of curve is applicable to all types of refractory concrete although variations do occur according to the type of cement employed and the refractoriness and type of aggregate. For instance, if a fused alumina aggregate is used instead of crushed firebrick a higher strength may be obtained in the cold and at temperatures up to 1,100 deg. C. due to the greater inherent strength of the fused alumina. On the other hand, the increased refractoriness of the fused alumina would delay the onset of ceramic bond until a temperature much higher than 1,100 deg. C. was reached. Similarly, if a t.c.p.a. cement/crushed firebrick mix were used, similar strengths could be expected up to 1,100 deg. C. to those obtained with the h.a. cement corresponding mix, but the greater refractoriness of t.c.p.a. cement would delay the formation of ceramic bond until a temperature of approximately 1,300 to 1,400 deg. C. was reached.

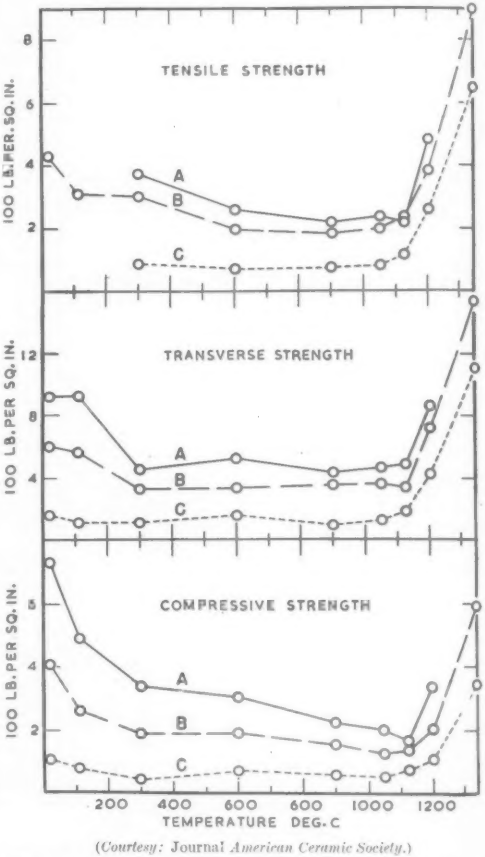
It is apparent from these curves that, for installations operating at temperatures well below the service temperature limit of the mix employed and where strength and abrasion resistance are prime considerations, it is advantageous to use a concrete with a relatively high cement content. It should be remembered, however, that in mixes containing an aggregate which is more refractory than the cement (*e.g.* h.a. cement/crushed firebrick), the service temperature limit of the refractory concrete tends to decrease with greater cement content—but this, of course, does not always apply to the t.c.p.a. cement mixes since this material may be more refractory than the aggregate employed.

Thermal Shock Resistance

The extremely low spalling tendency of refractory concretes made with either cement when they are subjected to rapid temperature fluctuations is well known, and it seems probable that this is due to the "elastic" nature of the alumina gel cement bond, owing to its micro-porous structure. Consequently, it is possible to employ a refractory aggregate of high spalling tendency and yet obtain a refractory concrete with good thermal shock resistance although, of course, the use of an aggregate of low spalling tendency is naturally advisable for extremely rapid temperature fluctuations.

Thermal Expansion Characteristics

In the manufacture of what may be termed "traditional" refractory bricks and units the general aim is the production, during the firing operation, of units which are fully shrunk, so that when put into service they exhibit reversible expansion and contraction on heating and cooling. Consequently, in the design of furnaces, etc., liberal provisison has to be made for expansion joints. One of the advantages of refractory concretes is that they do not normally require prefiring before being put into service, and this results in their expansion characteristics under service conditions being different from, say, a normal firebrick. This is particularly evident when the refractory concrete is first put into service and taken up to operating temperature since, during this first firing, moisture is driven off and the resultant shrinkage is superimposed on the inherent expansion of the aggregate employed. This operation is illustrated by the curve A-B in Fig. 2, and it will be noted that the dimensions at the operating temperature are, for all practical purposes, similar to the cast dimensions of the cold unfired unit, *i.e.* there is practically no expansion. On cooling, thermal contraction occurs and the



(*Courtesy:* Journal *American Ceramic Society.*)

FIG. 1.—*Comparison of the various strengths of refractory concrete (h.a. cement/crushed firebrick) containing differing percentages of h.a. cement, after the following treatments: 24 hr. at 20 deg. C., 24 hr. at 110 deg. C., 4 months at 300 deg. C., 4 months at 600 deg. C., 5 hr. at all higher temperatures indicated—(A) 30 per cent. cement, (B) 20 per cent., (C) 10 per cent.*

linear dimensions of the *fired* cold unit are slightly less than the cast dimensions. Further heating and cooling cycles cause reversible expansion as with a normal fired refractory, along the line B-C. In practical terms this means that up to temperatures of the order of about 1,300 deg. C., no allowance for expansion is necessary, and it is common practice to provide only butt-joints in a construction.

In concretes made with the t.c.p.a. cement operating at temperatures above 1,300 deg. C., the inherent thermal expansion of the aggregates is sometimes greater than the shrinkage of the cement bond, and very thin expansion joints may therefore be advisable. Furthermore, at these high temperatures ceramic reactions may occur as with other refractories, in specific cases, causing dimensional changes. For instance, the reaction between magnesia and alumina at high temperatures

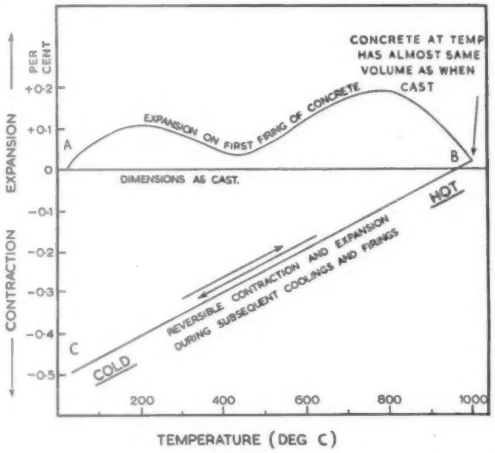


FIG. 2.—*Thermal expansion characteristics of refractory concrete (h.a. cement/crushed firebrick). Volume changes in the concrete when it is put into service are shown.*

is accompanied by expansion and, in some applications (particularly certain types of melting furnaces) this property may be used with advantage since the lining " tightens up " when fired. Similarly, the " normal " expansion characteristics of mixes with other aggregates (*e.g.* molochite, sillimanite, firebrick, etc.) can be varied to show a net expansion at operating temperatures by a very small addition of raw kyanite, which expands on heating.

Thermal Properties

Both the thermal conductivity and the heat capacity per unit volume of refractory concretes are usually less than the corresponding values of the aggregate or crushed brick from which they are made (except in the case of lightweight aggregates), and the thermal conductivity of refractory concrete made with a dense aggregate is usually about three-quarters of the value of the aggregate itself. Typical examples are given in Table 2.

TABLE 2.—*Typical Thermal Properties of Refractory and Insulating Concretes* (Mix proportions approx. 1 vol. cement: 3-4 vols. aggregate).

Aggregate.	Fired density, lb. per cub. ft.	Heat capacity, B.t.u. per (cub. ft.) (deg. F.)	Thermal conductivity, B.t.u. per (hr./sq. ft.) (deg. F. per in.)	Thermal diffusivity, (sq. ft. per hr.)
Vermiculite ..	35	9	1.2	0.011
Diatomite	55	14	1.7	0.010
Crushed H.T. insulating brick ..	85	21	3.2	0.013
Expanded clay ..	90	22	3.5	0.013
Crushed firebrick ..	115	29	6	0.017
Molochite ..	120	31	8	0.021
Sillimanite	135	33	10	0.025
Carborundum ..	145	40	50	0.103
Calcined bauxite ..	160	45	12	0.022
Magnesite	160	45	20	0.037
Chrome-magnesite ..	165	37	8	0.018
Fused magnesia ..	170	50	24	0.04
Fused alumina ..	175	52	16	0.026
Bubble alumina ..	95	22	6	0.023

The values given are, for all practical purposes, independent of the type of cement. Lightweight aggregates such as vermiculite, diatomite, foamed slag and crushed insulating brick are employed for insulating concretes where the primary consideration is heat conservation, but this type of concrete is not as strong or as resistant to abrasion or slag attack as concretes made with the normal denser refractory aggregates and is therefore more often used as a backing.

Resistance to Slag and Reducing Conditions

The slag resistance of a refractory concrete is obviously dependent, to a large extent, on the choice of aggregate, and where highly basic slags are encountered, a chrome, chrome-magnesite or magnesite aggregate is employed. Since the latter aggregates often contain a fair proportion of iron compounds (spinels), h.a. cement mixes are usually used since no appreciable advantage is gained by using the pure " iron-free " t.c.p.a. cement, although the latter cement should, of course, be employed with iron-free, slag-resistant aggregates such as sillimanite, fused alumina and fused magnesia. A t.c.p.a. cement/fused alumina mix is often used, since it possesses excellent resistance to both acid and basic slags, and a concrete made with a t.c.p.a. cement/sillimanite mix shows good resistance to soda slags in desulphurizing furnaces.

Although silicon carbide and carbon may be used as slag-resistant aggregates in refractory concretes, the cement bond cannot normally be expected to affect to any great extent the tendency of these materials to age or oxidize at high temperatures although, in the case of carbon aggregates, Patents have been taken out (which describe special mixes[2, 3] employing h.a. cement) which are claimed to be more resistant to oxidation.

At relatively low temperatures (450 to 500 deg. C.), carbon monoxide reacts with iron compounds in refractory materials (*e.g.*, firebrick) and may eventually cause disruption. Consequently, it is essential that refractory in contact with furnace

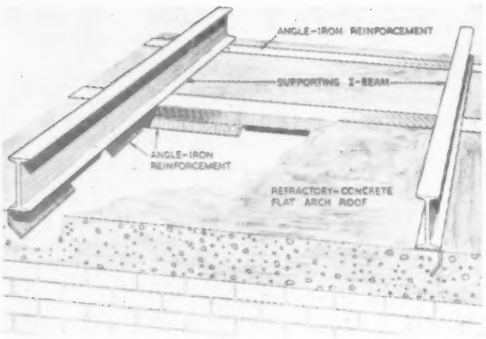


FIG. 3.—*Method of reinforcement in a cast-in-situ refractory-concrete flat arch roof.*

atmospheres containing some carbon monoxide at these temperatures should be free of iron compounds and, for this reason, refractory concretes made with the t.c.p.a. cement and an iron-free aggregate (*e.g.*, molochite, crushed H.T. insulating brick) are used. At much higher temperatures highly reducing atmospheres may attack the silica constituent in alumino-silica refractories, and a fused alumina aggregate should then be employed with the t.c.p.a. cement.

INSTALLATION

If the best results are to be obtained with castable refractories, it is essential that the basic principles of making ordinary concrete should be followed. For instance, the maximum size of the aggregate is governed to some extent by the minimum thickness of the unit or concrete being placed. Similarly, the aggregate should be evenly graded throughout the size range, and the amount of fine material passing a B.S.100 sieve should not exceed about 10 to 15 per cent. Aggregate with a deficiency of fine material is equally undesirable since the mix tends to be "harsh," with poor water-retention properties, which leads to compaction difficulties and a tendency to "bleed." Recommended mixes employing crushed firebrick are given in Table 3. Most of the other refractory aggregates are not available in the larger sizes and typical mixes are 1 vol. cement: 3-4 vols.

TABLE 3.—*Mix Proportions (by vol.) with Crushed Firebrick Aggregate and either Cement.*

Mix.	Cement.	Crushed firebrick.			Thickness of concrete or of mortar.
		Fine, $\frac{1}{8}$ in. to dust.	Medium. $\frac{3}{8}$ in. to $\frac{1}{8}$ in.	Coarse, $\frac{3}{4}$ in. to $\frac{1}{8}$ in.	
A	1	2	—	3	6 in. or over
B	1	2	2	—	2 in. to 6 in.
C	1	$2\frac{1}{2}$	—	—	2 in. or less

aggregate ($\frac{1}{8}$ in. to dust), and 1 vol. cement: 2-3 vols. aggregate ($\frac{1}{8}$ in. to dust).

Apart from the main exception of silica brick, a variety of refractory or semi-refractory materials may be employed as aggregate. They should, however, be free from impurities such as slags or jointing materials, and the mixer and tools should be free of any Portland cement, lime or plaster, which may chemically affect the hardening properties of the cement. It is therefore often more convenient to use one of the various proprietary castables, which consist essentially of suitably graded aggregate mixed with the correct amount of cement and merely require the addition of water. Premixes of this type are distributed by many reputable refractory manufacturers.

Most of the commonly used refractory and insulating aggregates are, of course, porous and therefore require pre-soaking if the best results are to be achieved. Water should be added to the aggregates, and mixed either mechanically or by hand until the initial suction is satisfied. Usually, 4 to 5 minutes in a mixer is sufficient. Any excess water should be then drained off and the cement mixed with the soaked aggregate. More water may be added to bring the mix to the correct consistency, which should not be too "sloppy."

Although normal compaction by hand is adequate for many applications, a denser concrete of better quality is obtained when vibratory compaction is employed (*e.g.* by using poker vibrators or attaching vibrators to the metal formwork for *in-situ* work, or by using vibration tables for precast units). The use of vibratory compaction means that less water is needed, and the workability of the mix should be suitably adjusted. A mix which has the correct workability for hand-compaction usually contains too much water for efficient vibratory compaction. It is not possible to specify the exact amount of water required, since this varies according to the mix proportions and the grading of the aggregate employed.

Any "bleeding" from joints in form work or moulds should be prevented, and any porous material on which the wet mix is placed should be either given a preliminary soaking or oiling or covered with waterproof paper. After the mix has set, all exposed surfaces should be kept cool and wet for a further 24 hours if maximum strength is to be obtained. In many cases of emergency, however, satisfactory results are obtained when the concrete is put into service only a few hours after placing. For instance, emergency gunning repairs have been effected on hot refractory at 1,000 deg. C. Refractory concrete may be put into service immediately after the curing period, and the first firing should preferably be fairly slow in order to drive the water off gradually, but this is, of course, not necessary with subsequent heating and cooling cycles. It is only in selective applications, however, that special care has to be taken with the first firing since, in most cases (*e.g.* annealing furnaces, etc.) the rate of rise of temperature is not too rapid.

When steel reinforcement is used in refractory concrete it should be located in a zone where the temperature is not expected to exceed approximately 400 deg. C. since, above this value, the strength characteristics of the steel itself rapidly

deteriorate. With normal reinforcing bars (which should not be hooked) R.S.J.s, etc., allowance should be made for the differential expansion of the steel and concrete. This is achieved by simply coating the steel with bitumastic material.

For many applications, wire mesh or expanded metal reinforcement is extremely suitable, and practice indicates that this type of reinforcement may be positioned in zones at much higher temperatures than normal heavy reinforcement. This is due probably to its less rigid nature. Mesh reinforcement is normally used when refractory mortars are placed by the gunning method. When steel castings are lined (*e.g.* flues), bolts are attached to the steel at approximately 12- to 18-in. centres, and extending about 1 to 2 in. from the casing (*i.e.* about half way into the lining). The mesh reinforcement is then tack-welded to the end of the bolts. The procedure for shooting refractory cement mortars on to existing concrete surfaces is similar, but it is important to chip and clean

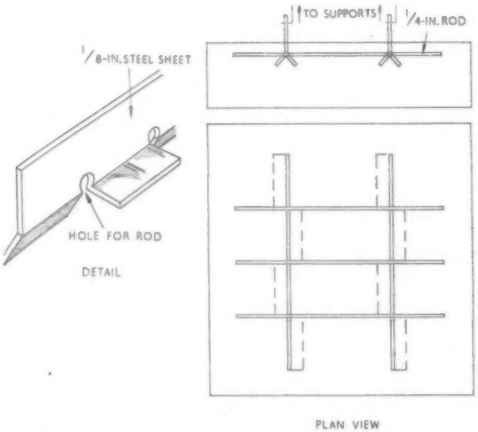


FIG. 4.—*Method of suspending a refractory-concrete flat roof, using steel "claws" (suspension of one unit—3 ft. 6 in. by 3 ft. 6 in.).*

the old concrete carefully as inadequate preparation can cause bad adhesion. The reinforcement must be pegged or dowelled firmly to the concrete, which should be thoroughly dampened immediately before gunning commences to "kill" any suction.

Modern furnace design is gradually moving over to the adoption of flat "arches," and castable refractories are obviously very suitable for this type of construction. Reinforcement is employed and, owing to the operating temperatures, special methods have to be adopted. In normal structural reinforced concrete the steel is bonded to the concrete and, in a load-bearing beam, design factors demand that the reinforcing bars should be in the lower half of the beam (*i.e.* the portion which is subjected to tensile forces when it bends under load). This procedure cannot be adopted in refractory concrete flat arches because the steel would be positioned in the hot zone which, of course, should be avoided. Two alternative methods are therefore adopted. In one method the load is transferred to the furnace side walls by heavy steel reinforcement (*e.g.* R.S.J.'s) which is partially embedded in the concrete. The supporting steel may be provided with different types of "claws," as shown in Fig. 3, but "I" beams alone, embedded up to the top flange, are also used successfully. It is essential that a portion of the embedded steel (*e.g.* the top flange of the "I" beam) should be exposed to the air since the temperature of the embedded steel is thereby reduced to a value less than the surrounding concrete, owing to the relatively high conductivity of the steel. For the second method, the flat arch is suspended from an independent steel framework as indicated in Fig. 4. The arch is a separate part of the structure, and the side walls are therefore not subjected to vertical or horizontal stresses, which obviates the necessity for massive buck stays.

APPLICATIONS

The advantages of castable refractories in the construction of heat-treatment and melting furnaces, flues, floors, etc., are now gaining wide recognition in the foundry industry. Although several large furnaces have been successfully constructed solely of refractory concrete, often with a backing of insulating concrete, this is, so far, unusual as such a departure from traditional methods is not taken lightly. It is therefore common to find that, in any one particular foundry, refractory or insulating concretes have only been used for certain parts of the furnaces (such as dampers, arches, hearths, bogie tops, foundations and flues, etc., or, in fact, for any part of the unit).

Apart from when basic refractory aggregates are employed, mixes incorporating h.a. cement are normally up to 1,350 deg. C. (see Table 4). Above this temperature, the pure white t.c.p.a. cement is employed with an appropriate aggregate (Table 5), although this cement is also employed at temperatures below 1,350 deg. C. when other factors such as slag attack, purity, or reducing conditions have to be considered. The temperature limits quoted should, as with other refractory materials,

TABLE 4.—*Approximate Service-temperature Limits of Refractory and Insulating Concretes made with High-alumina Cement.*

Aggregate.	Type of concrete.	Maximum temperature (deg. C.).
Vermiculite	Insulating	850–1,000
Diatomite	Insulating	850–1,000
Foamed slag	Insulating	1,050
Expanded clay	Insulating	1,100
Crushed high-temperature insulating brick	Insulating	1,350
Crushed firebrick	Refractory	1,350
Chrome-magnesite	Resistant to basic slags	1,600
Magnesite	Resistant to basic slags	1,600

NOTE.—The above temperature limits are dependent on the quality of the aggregate, and are generally applicable for the normal recommended mixes.

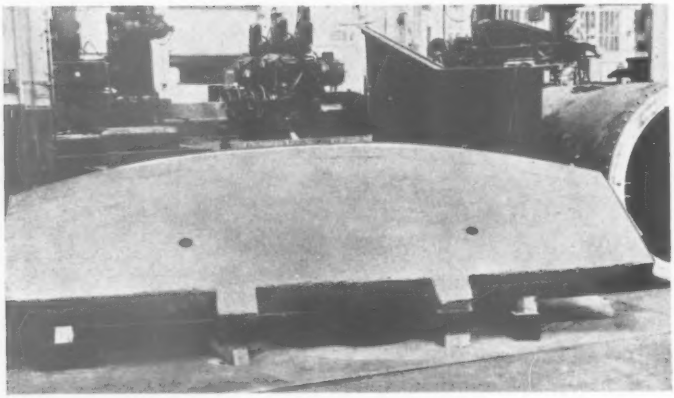


FIG. 5.—*Cast-in-situ refractory-concrete door (h.a. cement/crushed firebrick) of heat-treatment furnace.*

(*Courtesy: British Railways*).

TABLE 5.—*Approximate Service-temperature Limits of Refractory and Insulating Concretes made with Tri-calcium Penta-aluminte Cement* (*Secar* 250).

Aggregate.	Per cent. alumina content of concrete.	Service-temperature limit (deg. C.).
Crushed firebrick	47	1,450–1,500
Molochite (calcined china-clay)	50	1,500
Sillimanite (calcined kyanite)	64	1,600–1,650
Calcined low-iron bauxite	85	1,650
Chrome or chrome/magnesite	—	1,650
Carborundum	—	1,650
White fused alumina	96	1,800
Bubble alumina	90	1,700
Crushed high-temperature insulating brick	52	1,500

NOTE.—The properties given are dependent on the quality of the aggregate, and are generally applicable to the normal recommended mix.

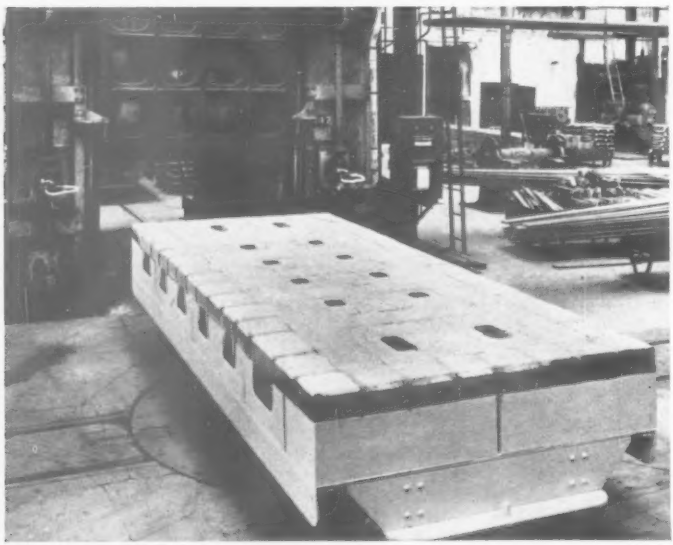
only be regarded as typical values for average conditions, and may be somewhat conservative where hot-face temperatures and negligible load conditions are the governing criteria. Similarly, the limits may be a little high for a unit heat soaked at the suggested temperature limit and under appreciable load.

Drying Ovens and Annealing Furnaces

The operating temperatures of core and mould stoves are usually not greater than 500 deg. C. and annealing furnace temperatures do not normally exceed 1,100 deg. C. These temperatures are well within the service limits of insulating and refractory concretes made with h.a. cement. In annealing furnaces particularly, the intermittent operation calls for refractories of low thermal conductivity and heat capacity in order to conserve fuel and allow shorter heating cycles. Consequently, insulating concretes are used extensively for the construction of doors and roofs, although the stronger and more abrasive-resistant refractory concrete (made with the crushed firebrick aggregate) is normally preferred for bogie tops.

Doors

The simplest method of door construction is to cast the wet mix (usually insulating concrete) in the door frame or casing, which in the case of large doors is normally provided with stud bolts positioned at approximately 12- to 18-in. centres and extending about half way into the thickness of the concrete. Large washers (*e.g.* 2 in.) may be fitted to the bolt heads, and both the bolts and the washers should be coated with bitumen. This method was adopted for the refractory-concrete door shown in Fig. 5, which is 12 ft. long, 4 ft. 4 in. at the centre, 2 ft. 10 in. at the sides, and 9½ in. thick. It is installed in a heat-treatment furnace operating at 1,100 deg. C. Previously, a firebrick door gave a service



(*Courtesy: Hurst, Nelson & Co. Ltd.*)

FIG. 6.—*Annealing-furnace bogie-top made with pre-cast refractory-concrete units.*

life of only two months, whereas a refractory-concrete door has so far given a life of over four years. In less frequent cases, doors are constructed with pre-cast refractory-concrete units. Such a door may consist essentially of nine tongued-and-grooved blocks (perhaps 3 ft. square and 9 in. thick) each block being keyed with four bolts wrapped in asbestos string.

Hearths and Bogie Tops

A smooth surface for hearths and bogie tops, undisturbed by partially displaced bricks, is of major importance in the handling of moulds, castings, etc., in and out of the oven. Although a monolithic bogie-top is often constructed, several users favour the employment of large pre-cast shapes, sometimes designed with interlocking joints, as shown in Fig. 6. The overall dimensions of this bogie are 14 ft. 3 in. by 6 ft. and the flues, visible at the top and sides, promote the circulation of hot gases around the furnace charge to obtain more uniform heating. A similar system is provided for in the cast-in-situ bogie top (approximately 33 ft. by 11½ ft. by 15 in. thick) in Fig. 7, shown in process of construction. The top was cast as follows: bottom 4½ in. insulating concrete (vermiculite aggregate); next 4½ in. semi-insulating concrete (equal proportions of vermiculite and crushed firebrick aggregate), and the top 6 in. refractory concrete (crushed firebrick aggregate). The top 6-in. layer was placed in sections approximately 2 ft. 9 in. by 1 ft. 6 in., with butt-joints as shown in Fig. 8. Refractory concrete only was used for the mould-stove bogey top (25 ft. by 10 ft. by 6 in.) shown in Fig. 9, although a h.a. cement/vermiculite insulating concrete was used for the 4½-in. lining of the door (12 ft. 6 in. by 13 ft.), also shown.

Owing to the unique expansion characteristics of refractory concrete, the butt-joints are closed at operating temperatures but open when the concrete cools to room temperature, when it is possible that they may become filled with sand. On re-heating, the concrete expands to fill the contraction gap and any sand in the joint would tend to resist this movement particularly in view of the high expansion characteristics of silica sand. Normally, however, good service is obtained with the straight vertical butt-joints, but sand can be more easily removed (merely by blowing it out with compressed air) if the joints are of the shape illustrated in Fig. 10. Another method which has been adopted, at least in one instance, is where one joint approximately 2 in. thick surrounding the central area of the bogie top is filled with a lean mix of vermiculite concrete (approximately 1 vol. h.a. cement: 6 vol. vermiculite) which has sufficient elasticity to take up any expansion or contraction movements and, at the same time, prevent sand filtering in. This top again consists of a base of vermiculite concrete topped by refractory concrete (crushed firebrick aggregate).

Similar procedures are also adopted for the hearths of core stoves and annealing ovens and the concretes are normally cast-in-situ, although some users prefer a hearth constructed of pre-cast slabs. For instance, one annealing-furnace floor on which heavy castings were dragged had only six weeks

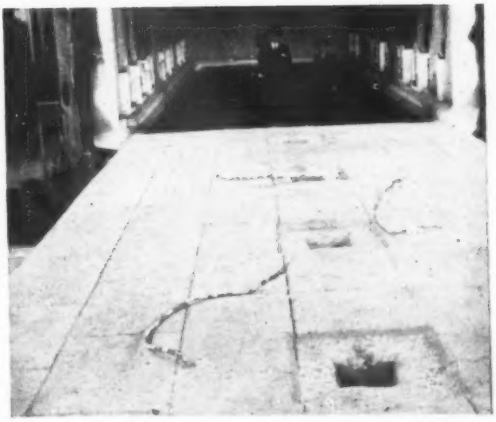


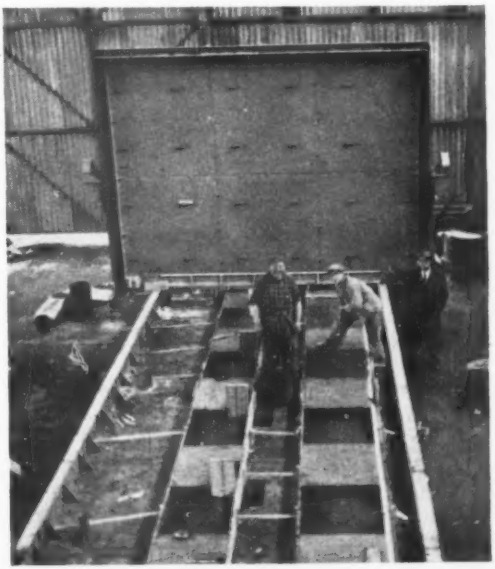
FIG. 7.—*Cast-in-situ bogie-top of refractory- and insulating-concretes.*

life when constructed with standard firebricks. A much improved life was obtained by topping the floor with precast refractory-concrete slabs (*e.g.* 3 ft. by 2 ft. by 4 in. thick). Slabs of this type should be laid on a flat level base to avoid proud joints, with all edges in contact so that the joint thickness is negligible.

Arches

Owing to its suitable thermal properties and lightness, insulating concrete is more often employed

FIG. 8.—*Method of constructing a cast-in-situ bogie-top in chequer-board fashion to obtain butt-joints.*



(*Courtesy: Atlas Steel Foundry.*)

FIG. 9.—*Cast-in-situ mould-stove bogie-top, constructed by using both refractory- and insulating-concretes.*

for the flat roofs of core stoves or annealing furnaces, and in this country the method of construction employing partially embedded heavy reinforcement (see Fig. 3), is favoured. Roofs of this type have been found to be still in good condition after almost 20 years' service. The example shown in Fig. 11 is interesting, since the reinforcing steel members are fully embedded. Although this is permissible for core stoves owing to the relatively low operating temperature this lack of provision for cooling the steel should *not* be adopted for annealing furnaces, etc., operating at higher temperatures —part of the steel should be exposed to the atmosphere, as shown in Fig. 12, in which an insulating concrete roof (vermiculite aggregate) has been cast on corrugated sheeting slung between the girders. In some cases, the sheeting is left in position.

The method of installing a fully suspended flat roof (see Fig. 4) for an annealing furnace has been fully described[4]. Steel and refractory anchors were employed in this furnace for both the roof and side walls (*i.e.* the whole furnace was a steel-cased reinforced insulating-concrete structure). Although refractory anchors may be considered more efficient than steel "claws" (since they can extend through the full thickness of the concrete to the hot face), they are more expensive, and practice indicates that properly designed steel reinforcement alone is satisfactory for suspended arches in furnaces operating below, say, 1,100 deg. C.

Although flat furnace roofs are the modern trend, refractory and insulating concretes have, of course, been used for many years for constructing the normal type of sprung arch. The two main properties causing the vertical and horizontal stresses in a sprung arch are the weight and expansion of the refractory. Apart from any advantage gained by monolithic construction, it is the comparatively low weight and negligible expansion at operating temperatures which favour the use of refractory concretes for this type of arch, and which accounts for the fact that more latitude in the relationship of span, thickness and rise is apparently allowable. For instance, arches with spans up to 16 in., and rises varying from 2 to 6 in. per ft. have been built. A typical example is shown in Fig. 13, which illustrates a refractory-concrete arch (mix A, Table 3) 11 ft. long by 8 ft. 9 in. span and a rise of 21 in. (*i.e.* approximately 2½ in. per ft.). The roof was cast-in-situ with two transverse butt-joints and one longitudinal joint along the centre of the arch, apart from the third section near the door, which has two

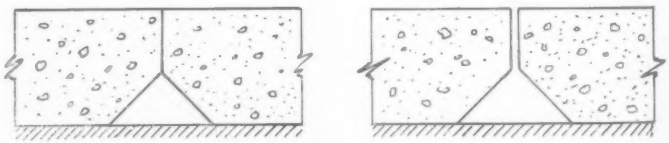


FIG. 10.—*Method of constructing butt-joints to facilitate removal of sand, etc.*

FIG. 12.—*Reinforced insulating-concrete (vermiculite) flat roof of an annealing furnace which was cast on corrugated sheeting slung between the girders.*
(Courtesy: George Richards & Co., Ltd.)

longitudinal joints at the third points. The furnace is employed for annealing malleable iron at a maximum temperature of 1,050 deg. C. with a 90-hr. working cycle, and it is interesting to note that, although the refractory concrete arch is the same thickness as the firebrick arch previously installed, the heat losses have been decreased to such an extent that it has not been found necessary to place the customary 9 in. of sand on the top of the arch.

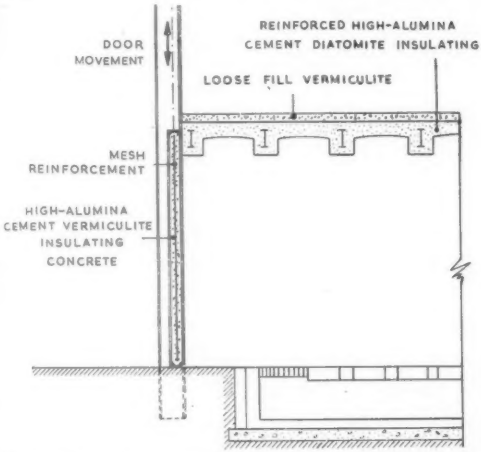


FIG. 11.—*Reinforced insulating-concrete flat roof and door of a core-drying stove.*

As in other applications, arches are often constructed of precast units. The arch ribs are usually approximately 2 ft. thick by 2 ft. wide with a 6-in. span, and even larger ribs weighing over three tons each have been used in the arch of one large annealing furnace—the hearth and flues incorporated in it were constructed with insulating concrete (crushed H.T. insulating brick aggregate). It is also now common practice to use refractory-concrete springers in orthodox brick arches. An interesting development of this was incorporated in a heat-treatment furnace, where the springers consist of 12-ft. long steel ducts encased in refractory concrete and thus serve as air pre-heaters.

Insulating concretes are favoured for lining the covers of "Top Hat" or bell-type annealing furnaces, and the lining is often installed by the "gunning" technique using, of course, suitable mesh reinforcement. Refractory concrete is, however, preferred for the hearths.

Fireboxes and Burner Blocks

The burning rate in solid fuel-fired core-stove fireboxes is relatively low, and ordinary refractory concrete (h.a. cement/crushed firebrick) is therefore sufficiently refractory and, in practice, gives very good service as linings, arches, etc. In one interesting application, the firebox roof, of span 2 ft. 9 in., was flat and constructed of precast interlocking refractory-concrete lintels. These proved satisfactory, but since very light cracking occurred holes were cast in the lintels to take steel rod as a precautionary measure. It is now standard practice to

FIG. 13.—*Cast-in-situ refractory-concrete arch (h.a. cement/crushed firebrick).*
(Courtesy: T. H. Mold & Son, Limited)

FIG. 14.—*Detail of one of the* 16 *refractory-concrete burner-blocks in the annealing furnace shown in* FIG. 7

cast all types of burner blocks and the mix employed is, of course, dependent on the type of burner, operating temperature, etc. Ordinary refractory concrete (high-alumina cement/crushed firebrick aggregate) is frequently used for casting the oil burners of annealing furnaces, etc., but in certain instances the pure t.c.p.a. cement has been employed to obtain increased refractoriness. For instance, this cement (with a chamotte aggregate) was used for casting the sixteen burners of the annealing furnace shown in Fig. 7. The blocks are shown in greater detail in Fig. 14.

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[2] B.P. 646,524 (1950).
[3] B.P. 646,534 (1950).
[4] Witschey, R. A., *Foundry*, 1949, **77** (9), 80.

(*To be continued next week.*)

Scrip Issue proposed by Acrow (Engineers)

Proposal to make a one-for-seven scrip issue in "A" shares is announced by Acrow (Engineers), Limited, structural engineers and builders' plant manufacturers, of London, W.2. A year ago holders received one new for every six ordinary shares held.

In June, when the company made an offer for the shares of Hardwick Industries, Limited, the directors anticipated paying not less than 40 per cent. for 1958-59. It is now learned that by raising the final dividend from 10 per cent. to 12½ per cent. a total (with the quarterly interims) of 42½ per cent. for the year ended March 31, 1959, will be paid on increased capital against the equivalent of 30⅞ per cent.

Consolidated trading profits amounted to £675,423 (£636,555) and the net profit is £309,005 (£240,619).

Iron *v.* Plastic Gas Mains

Correspondence in recent issues of *The New Scientist* has discussed the respective claims of cast-iron and plastics as materials for underground mains. In the course of one letter, an engineer concerned with the laying and maintenance of gas mains for 36 years, expressed the view that "gas distribution engineers will require longer experience of the use of plastic pipes before they feel that they can partially replace cast-iron pipes by them, even in the smaller sizes. When I made careful inquiries a year or two ago as to the general feeling in this matter in the USA," (the writer continues) "I learnt that no type of plastic pipe was considered suitable for conveying manufactured gas containing aromatic hydrocarbons, due to the softening effect of these on the material. I note from the report of the Committee for the Study of New Gas Distribution Techniques, given at last year's conference of the International Gas Union in Rome, that this view is maintained. I also had a number of types of plastic pipes tested over long periods under laboratory conditions which confirmed this view. P.V.C. was found to give the best results having regard to this feature, but it was not found to be suitable for conveying gas which had not been stripped of benzol.

"Another feature which has to be borne in mind is that plastic pipes can be readily deformed, and this is of importance when considering the depth at which mains have sometimes to be laid involving pronounced external loading, and the heavy vehicular traffic that has to be carried by carriageway, and sometimes vicariously by footway surfaces under which the mains are laid.

"It is also necessary to take into account the widespread use of mechanical trench diggers, and the fact that pipe trenches so dug are often not 'bottomed up' as carefully as in the past. Many engineers, gas and otherwise, hold the view that plastic materials gradually take a set under load. A further point is the liability of plastic pipes to be more easily affected by subsequent excavations than iron pipes.

"The last point I would refer to is that plastic pipes have a coefficient of linear expansion about eight times or so greater than that of iron, and experience has to be obtained as to what effect, if any, this may have on the technique of main-laying.

"Gas engineers have had more trouble with the corrosion of steel service pipes than with cast-iron main pipes, and I think that they are wise to get comprehensive experience of the use of plastic pipes for service laying before using them for main-laying work."

* Extract from a recent *Bulletin* of the Council of Ironfoundry Associations.

Industrial Production Index

Manufacturing industry, notably the consumer goods trades, is thought to have accounted for a large part of the further increase in industrial production in July. The index, seasonally corrected, reached a new record level at 111-112 (1954=100). This is 1 to 2 per cent. above the second quarter average and 3 to 4 per cent. above the first quarter.

The index, which was 106 for July, 1958, reached 107 in January and February and, after standing at 109 for the next three months, is confirmed by the Treasury at 110 for June. The index for mining and quarrying in June was 97, compared with 92 in the same month last year; for manufacturing it was 115 (110), and for gas, electricity, and water, 104 (101).

Vacuum-melting at the Works of Jessop-Saville, Limited

In recent years there has been a continually increasing demand for new and better materials, to keep pace with the needs of design engineers. This has long been recognized by Jessop-Saville, Limited, of Sheffield, who have concentrated on a programme of intensive research into the development of new alloys and new metals. These investigations have led to the introduction of new processing techniques, one of the most outstanding being that of melting in vacuum.

The introduction of the vacuum-melting process opened up new horizons for the study and production of a completely new range of metals and alloys which must be essentially melted in the absence of air. Particular examples of these metals are titanium and zirconium. It was, however, found that the vacuum-melting process would also considerably improve the characteristics of many existing steels, and in fact allow the production of new alloy steels which could not be made by any other method. The two methods adopted by Jessop-Saville, Limited, of Sheffield, for vacuum-melting were the consumable electrode arc-melting process, and the high-frequency induction-melting process.

Initial Developments at Jessops

Early in 1956 the Jessop vacuum-melting plant came into full-scale operation. The melting furnaces were of the consumable-electrode type, capable of producing titanium ingots with diameters up to 20 in., and up to 1 ton in weight. Some time prior to this a small 20-lb. vacuum-induction-melting furnace had been installed for research development work. It was soon realized that, with the increasing demand for these new materials, the plant would not satisfy all requirements, particularly for the larger forgings, and the decision was made to increase production facilities. The new Heraeus consumable-arc melting furnace has now been installed and is fully operational. This is capable of melting titanium ingots of up to 24 in. dia., weighing more than 2½ tons. Also recently installed, and now fully operational, is a new 600-lb. Wild Barfield/NRC high-frequency induction-melting furnace. These furnaces in combination are claimed to make up the largest operational vacuum-melting plant outside America.

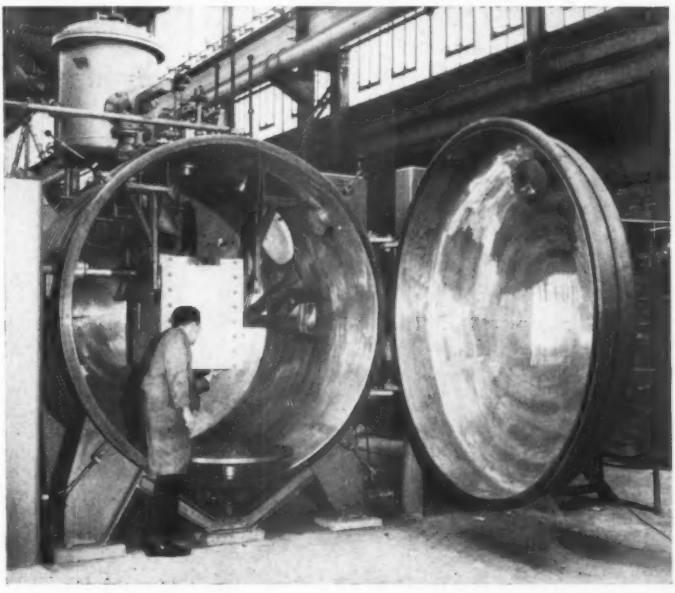


FIG. 1.—*Wild Barfield/NRC high-frequency vacuum-induction-melting furnace at the works of Jessop-Saville, Limited, of Sheffield.*

Potentialities of Vacuum-melting

Freedom from Non-metallic Inclusions

Vacuum-melting will not satisfy all the demands the engineer makes on the metallurgist, but it does represent a considerable advance in many metallurgical problems. Turbine and compressor-disc materials, used in gas-turbine aircraft engines, must be virtually free from non-metallic inclusions. Vacuum-melting can not only ensure this, but also provide the designer with enlarged scope for even more highly-stressed conditions. This freedom from non-metallic inclusions also means that the transverse ductility of forged discs is improved. Tensile tests on vacuum-melted 12-per-cent. chromium-steel discs have, for instance, given elongation values four times greater than those obtained from discs made from air-melted material.

Reduction in Gas Content

Vacuum-melting reduces the total gas content of the metal. Tests with air-melted steel have shown

Vacuum-melting at Jessop-Saville

that remelting in vacuum reduces the total oxygen, hydrogen and nitrogen content of the steel from 600 to 200 parts per million. This feature of the process is particularly useful in the production of stock for precision castings, or for remelting prior to precision casting, for in this way undesirable blow-holes and gas pockets can be avoided. The production of certain steels with low-hydrogen content minimizes the need for the long immunization heat-treatments which are necessary to avoid the danger of hair-line cracking.

Fresh Fields of Development

Induction-vacuum melting has made possible the production of alloys which, because they contain elements which readily oxidize, could not formerly be produced by conventional air-melting methods. This new technique has also opened up fresh fields in the development of high-temperature materials. One such alloy, Jessop G.64, contains high percentages of aluminium and titanium, and can only be made satisfactorily in a vacuum-melting furnace. It has excellent high-temperature properties, and is being assessed for stator and turbine-blade applications. The advent of nuclear-power plants has posed further problems for the metallurgist in the demand for new materials. One of these materials is zirconium, which can only be produced by vacuum-melting. Jessops are developing a range of zirconium alloys, some of which are already in commercial production. In many nuclear applications it is essential that certain tracer elements in steel be reduced to an absolute minimum. The vacuum-melting technique permits close control of the chemical composition of every melt, and enables certain elements to be completely removed, and others kept to the specified minimum.

Wild-Barfield Melting Unit

The Wild Barfield/NRC 600-lb. vacuum-induction melting unit at Jessop's is shown in Fig. 1. It is designed for semi-continuous operation, provision being made to accommodate sufficient ingot-moulds for several heats on the rotary mould-table. The furnace may be charged through a bulk-charging hopper without breaking the vacuum in the melting chamber,

Stainless-steel Vacuum-chamber

The principal unit of this installation is a horizontal vacuum-chamber, constructed of stainless steel, approximately 7½ ft. in dia. by 9 ft. long. The end of this chamber is sealed by a hinged door; the whole of the chamber and door is water-cooled through copper coils brazed to the outside of the unit. This chamber contains the high-frequency induction-melting coil, which is designed to tilt about the pouring axis, and immediately in front of and below the furnace there is a rotary mould-table which allows several ingot-moulds or castings to be poured from one melt. Provision is made for the observation of all stages of the process through three observation windows, each one equipped with shields and wipers.

External Controls: are provided for the following apparatus:

(1) Bridge breaker for breaking the top layer of unmolten metal in the crucible.

(2) Immersion thermocouple pyrometer for temperature measurement.

(3) Sampling device, which can be extracted through an air lock without breaking the main tank vacuum, for compositional control during melting.

(4) Sighting tube for optical pyrometer readings.

(5) Internal light-assembly for illumination of the tank interior.

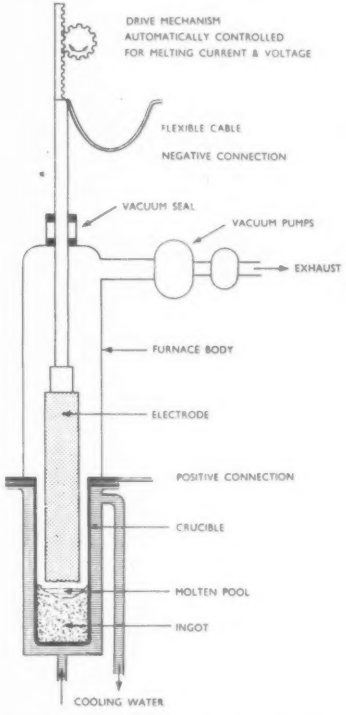


FIG. 2.—*Simplified diagrammatic layout of the Heraeus furnace.*

Alloy-charging

A cylindrical chamber, situated on top of the horizontal melting-chamber, contains the alloy-charging mechanism. This mechanism consists of a 2,200-cub.in. bulk-charging hopper with a capacity of 300 lb., and four smaller hoppers, each of 90 cub. in. and holding a further 12 lb. of alloys each. Both bulk charge and alloys are delivered to the crucible, by a vibrating feeder, through a 6-in. dia. vacuum lock. Alloy buckets are individually tripped by solenoids operated from the control panel. The vibrator feeds into a chute, which swings over the crucible, and an interlock is provided which prevents the vibrator from operating unless the chute is in position. The whole of this chamber may be refilled,

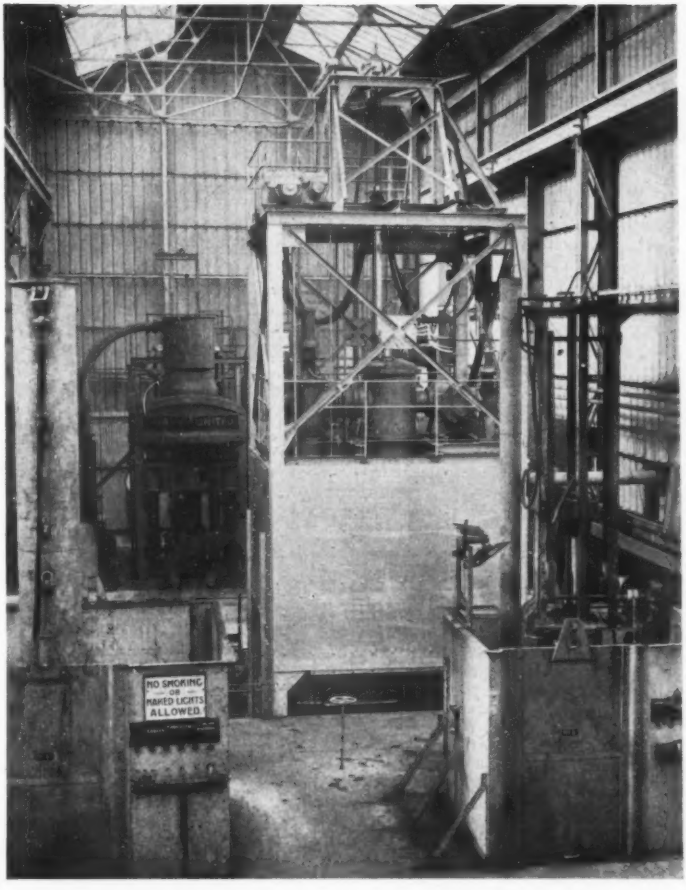


FIG. 3.—*The Heraeus consumable-arc vacuum-melting furnace at Jessop's.*

without breaking the vacuum in the main tank, by closing the 6-in. dia. vacuum lock. A special pumping line is provided to evacuate this chamber after it has been recharged with material.

Pumping System

The pumping system is designed to handle the gases from the 600-lb. molten charge during melting, purifying and alloying. The pumps have the necessary capacity for disposal of the gases as they are given off from the melt. Pneumatic operation is provided for all the vacuum valves used during the pumping cycle. The vacuum system consists of a large 16-in. dia. high-vacuum manifold and a 6-in. dia. rough-pumping line connected to the end face of the melting chamber, to give rapid and complete evacuation of the chamber. This combined system can evacuate the furnace chamber from atmospheric pressure to a pressure of one micron of Hg in 15 min. Vacuum gauges indicate the furnace tank pressure, from 1 micron to atmospheric pressure. The vacuum instruments consist of one alphatron gauge, and a five-point thermocouple vacuum gauge. Operating platforms are provided for easy access to the controls and observation windows. The control panel for the electrical and pumping systems is mounted on the main operation platform. The power supply for the melting is a 200-kw. motor alternator set, working at 400 v. and 3,000 cycles per sec. The furnace is to be used for melting iron, nickel and cobalt-base alloys.

Heraeus Arc-melting Furnace

The Heraeus consumable arc-melting furnace (shown in Figs. 2 and 3) consists of a large vacuum-tight vessel evacuated by pumps which are capable of handling large volumes of gas at high vacuum. The actual melting is carried out in the copper crucible which forms the lower half of the furnace. An electrode is placed inside the furnace, where it is welded onto the feeder rod under high vacuum conditions. The electrode can then be driven up or down, to control the melt, by applying drive to the feeder rod. This feeder rod also carries the melting current, through sliding vacuum seals, from the electrical busbars down to the electrode.

Melting

The melt is started by striking an arc between the bottom of the electrode and a small charge placed at the bottom of the crucible. The heat generated by the arc provides sufficient heat to melt the tip of the electrode. Molten metal sprays down to form a pool which, when solidified, forms the ingot. As the molten pool is only of small dimensions great care must be taken to ensure that melting conditions are kept constant throughout the melt. A view of the melt is projected onto the melting control-deck alongside the many electrical gauges. The melting operator here is able to assess the furnace conditions and make any necessary modifications.

Automatic Controls

The furnace components (pumps, valves, etc.), are actuated remotely from a control cabinet. There is provision for automatic operation of all vacuum equipment, so that when the furnace is closed evacuation continues through all its stages entirely without supervision. This automatic

Vacuum Melting at Jessop-Saville

system also safeguards the vacuum equipment in cases of component failure. For safety, the arc current is interlocked to all operations which, if faulty, could lead to dangerous conditions. A section of the cabinet is given over entirely to indication of possible breakdowns, so that rapid rectification can be made. An electrical control unit drives the feeder rod as required by the melt. Arc gaps can be maintained within fine limits when using this unit at maximum sensitivity, and it is possible to apply a current of 18,000 amps. to the electrode. The vacuum equipment is capable of holding melting-pressures below one micron. In this pressure range, the arc is very stable. There are two pumps fitted for the final evacuation of the furnace (a roots and a booster pump). Their combined speeds are: four thousand litres per sec. for air, and ten thousand litres per sec. for hydrogen.

The titanium ingots produced range from 9 in. dia. (120 to 420 lb.) to 24 in. dia (2½ tons). The plant is capable of producing zirconium ingots, but it is likely that initial production will be confined to ingots up to 800 lb. in weight. Steel ingots up to approximately 3 tons in weight can also be produced in the same sizes.

Offer for Webley & Scott

Preliminary information concerning operations for the 15 months ended March 31, 1959, has been made available to assist shareholders of Webley & Scott, Limited, Birmingham engineers and machinists, to come to a decision regarding the offer by Arusha Industries, Limited. Group net profit amounted to £46,274 and the balance for distribution is £24,589 after deducting pre-acquisition profits and retentions by subsidiaries.

Preference dividends of £1,756 and ordinary interim dividends totalling 12½ per cent. absorbing £16,676 net have been paid and no further dividend is recommended for the period. Consolidated net assets applicable to ordinary shareholders amounted to £691,000. Indebtedness to bankers on March 31 was £548,156, but this has increased to over £600,000 on August 31.

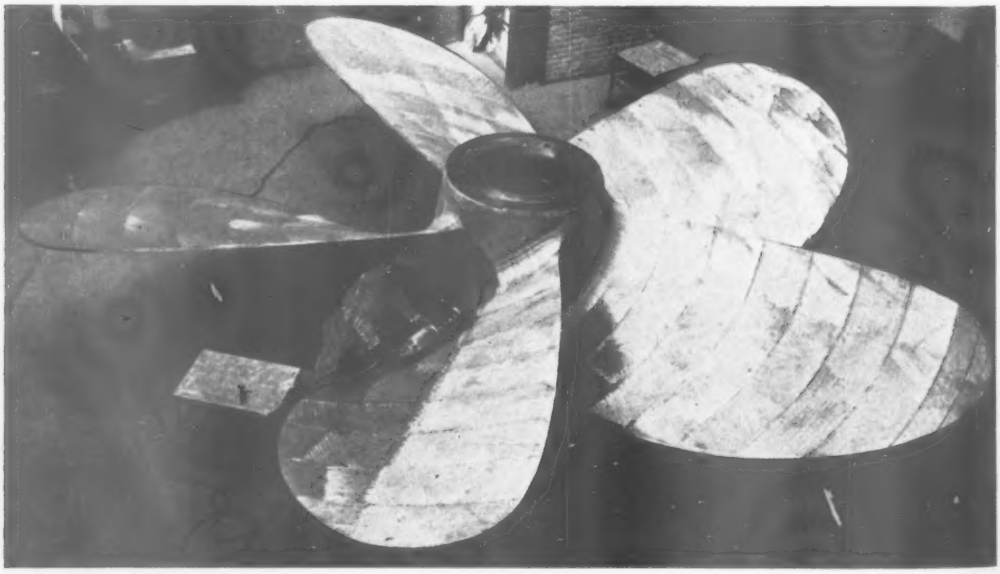
The directors reiterate that in all the circumstances they remain convinced that association with Arusha under the terms of the offer (which is now unconditional) cannot but result in benefit to the company.

Franco-British & General Trust, Limited, which asked for further explanations of the board's recommendation of the Arusha offer, has been informed that association with a large group would offer much wider benefit to shareholders. The chairman of Webley & Scott, Mr. R. E. G. Windsor, has agreed on behalf of the Windsor family to accept the Arusha offer.

Largest Propeller in New Alloy?

At the end of last month, what is believed to be the largest high-tensile nickel-aluminium-bronze (BS.1400-AB2-C) propeller ever cast in the world, left the foundry of Lips, N.V.Drunen, on its way to Verolme's United Shipyards at Housden, *en route* to Dunkirk, via Rotterdam.

The propeller has a diameter of 25 ft. and a weight of 38 tons. At Dunkirk, it is to be fitted to a single-screw 72,600-ton tanker being built by Ateliers et Chantiers de France to the order of Tidewater Oil Company. The tanker which is 860-ft. long is reported to be the largest ship ever built in a French yard. Road transport was arranged on a special 16-wheel trailer. (It is interesting to note that this propeller is larger than those on the Queen Mary, as she is a four-screw ship.)



Air-pollution Control

By Donald S. Fraser

Extracts culled from discussions, held at the recent National Conference on Air Pollution in the USA, on "accomplishments by the steel industry." Many recent developments in dust-extraction are described, and various "emission problems" are commented upon.

The National Conference on Air Pollution, which was held recently in Washington, D.C., USA, brought to light many interesting aspects of what has been accomplished by the steel industry in the United States with this vital problem. Whilst individual companies have for many years spent money on smoke-abatement research, the American Iron and Steel Institute only became actively interested in 1950. In that year the Institute signed a contract with the Industrial Hygiene Foundation of America at Mellon Institute to pursue work in air-pollution abatement. At that time, conditions in the field were less than ideal. It was difficult even to define the problem to be solved, since there had not yet been developed simple, effective and inxpensive instruments which could take a sample that was truly representative of either the ambient atmosphere or of stack gases. The Mellon group developed instruments and techniques which were useful in these fields.

Instruments Developed

Amongst the instruments developed was an automatic smoke-filter, which samples the atmosphere for successive short-time periods (measured in hr.), and which permits the tracing of variations in smoke intensity, which are largely due to weather, thus making possible comparisons between different districts, and between different seasons. A hydrogen-sulphide sampler (which continuously monitors the atmosphere) and an instrument for measuring hourly dust-fall rates with a high degree of precision were also developed. Coupled with the introduction of the instruments was the development of the techniques required for their utilization. At the same time a research programme on stack-sampling was carried out.

Training School

A training school was set up to which various members of the American Iron and Steel Institute sent representatives to be trained in the techniques used in air-pollution studies. It was at this school that existing cleaning equipment was critically examined, with a view to classifying it into groups of optimum usefulness. No single device was found which could do all the things necessary to meet air-cleanliness requirements. An attempt was then made to develop a new type of filter device which would fit into the metallurgical stack-gas cleaning programme, and after studies of various filtering devices were made a new type of continuous self-forming filter was devised from slag wool revolving in a horizontal plane.

The filter combines in one device the versatility of a scrubbing or washing device for gases, with the high efficiency of a fibre filter for particulate matter. Mineral wools withstand temperatures greater than 538 deg. C., permitting their use on flue gases and furnace effluents. The wools being used are made from blast-furnace slag, are reusable many times, and give efficiencies greater than 90 per cent., it is claimed.

Continuous Progress

Research is going ahead to seek means to control particulate emissions from Bessemer converters, and to endeavour to prevent the formation of fumes in the metal bath. Fortunately, however, this type of steel producer is rapidly disappearing in America, and smoke-control authorities are expecting attrition to solve this problem. Over the years, the American steel industry has been searching out the most obvious air-pollutants and correcting them, wherever possible. Many steam boilers have been converted from coal- to gas-firing, and many process-heating furnaces converted from coal-firing to natural-gas-firing, or to electric heating.

EMISSION PROBLEMS

The raw material used in largest quantity by the steel industry is air. During the production of 100,000,000 tons of steel, from raw materials to finished products, 1 billion tons of air is used and must, of course, be returned to the atmosphere. In many cases it contains both coarse and fine particles. These particles originate in the mechanical and chemical reactions of hot gases in the in-process materials inside sinter machines, coke ovens, blast furnaces, melting furnaces, converters, soaking pits or on scarfing beds; or from chemical reactions, agitation in a molten bath and combustion of fuels.

Coke Ovens

Coke ovens have been, and are, sources of smoke, and the problem of the emissions at the time of pushing and of quenching the coke is still to be dealt with. Improvements in design have resulted in built-in equipment to shorten the time of charging, vacuum-charging equipment to ensure minimum emissions during charging, equalizer mains, and self-sealing doors, all of which have had a good effect.

Blast Furnaces

Blast furnaces produce about 150,000 cub. ft. of gas per ton of iron melted. The gases produced are

Air-pollution Control

all cleaned to comfortably meet the 0.40 lb. per 1,000 lb. of gases required by many control boards. There is, of course, recoverable gas of approximately 90-B.Th.U.'s heat value. A large number of protective devices have been added to blast furnaces in recent years, and in many cases the cleaned burned gases emit less than 10 lb. of dust per ton to the atmosphere. The dust-catching equipment on blast furnaces is varied and costly, and almost all types are employed, including venturi and orifice scrubbers, tower washers and electrostatic precipitators.

" Slips "

Occasionally a blast furnace " slips," that is its burden shifts downward rapidly, thus opening safety-bleeder valves to relieve pressure. When this happens, some dust is ejected into the atmosphere, or the top will blow off the furnace. However, " slips " have been reduced by improved ore burdens and practices. In many cases bleeders have been installed on the clean-gas side of the blast-furnace gas-cleaning system, which prevents the dirty gas from escaping.

Open-hearth Furnaces

The effluent from open-hearth furnaces represents the industry's largest and most persistent problem. The results of research to date indicate that precipitators, high-energy scrubbers, or filters may be required. Installations presently operating on open-hearth gas-cleaning employ waste-heat boilers to reduce the gas temperature, and electrostatic precipitators to do the cleaning. On many furnaces automatic combustion controls have been installed to control the fuel-to-air ratio, which results in more complete combustion and consequently less effluent. The new basic oxygen steelmaking process has required special equipment to suppress effluent. This has been done very successfully by the use of spark traps, and wet washers (such as disintegration and high-energy scrubbers) followed by moisture eliminators.

" Bag-houses "

Electric furnaces have had their share of attention. The most popular type of air-cleaning device in use on electric furnaces is the " bag-type " (in effect a giant vacuum-cleaner). Dusts from an electric furnace carry all smoke from the melting operation to a four-room building known as the " bag-house." In one new installation there are 195 dacron bags (fifteen ft. long and six in. in dia.) in each room. These bags collect the dust from the air which passes through them. Once an hour one room at a time is shut down automatically, and the bags shaken vigorously. The dust from the bags falls into a collecting hopper, where it is mixed with water to form sludge which is settled and dumped. This installation, which can also be used on the basic oxygen process, has a very high efficiency.

Ferro-manganese Furnaces

Ferro-manganese furnaces produce an effluent which, if unchecked, is the most prolific of any of the metallurgical processes. By means of electrostatic precipitators particulate matter is recovered from the effluent. This matter is then treated by roasting, and finally put through a process of briquetting before being sent to the dump. There is no economical recovery of this material, and the only compensation is that the cleaned effluent gases can be used under boiler-house furnaces (although they have a B.Th.U. value of only 120).

Improvements Already Made

Many other operational units of the American steel industry have been safeguarded. Boiler houses have been equipped with electrostatic precipitators, and raw-material preparation has reduced dust considerably. Water sprays have been installed on car dumpers at ore- and coal-handling facilities. Sinter plants have been protected by cyclone cleaners, and water sprays on cooling tables. Scrubbers have been installed on coal pulverizers and coal washers. Soaking pits have been protected by waste-gas controls. Scarfing beds and scarfing machines have been equipped with cyclone dust-catchers, electrostatic precipitators and wet washers.

CONCLUSION

This article has sketched only the outlines of what has been done—many old problems remain, and new ones will arise. There is much research and development in progress, and the American steel industry is attempting to solve all problems pertaining to air pollution as speedily as possible. Mr. Max D. Howell, executive vice-president of the American Iron and Steel Institute, has said: " We hope that we shall be permitted to work out the solutions to our problems without being hampered by restrictive legislation, which can have little grounding in reality until the state of the abatement art is more advanced than it is to-day." [This last sentiment will undoubtedly be regarded somewhat ruefully by UK founders, who have already experienced considerable difficulty in implementing the requirements of the Clean Air Act.—EDITOR.]

A NEW COMPANY—Renault Machine Tools (United Kingdom), Limited—has been formed to take over production and marketing of the Renault machine tools for automation, previously manufactured in Britain under licence by Sentinel (Shrewsbury), Limited. The new company is operating temporarily from the Sentinel Works in Shrewsbury until other accommodation in the town is ready—probably in the autumn. The board comprises four French directors and two executives from Sentinel (Shrewsbury).

NEW PRIVATE COMPANY—Joseph Lucas (Group Services), Limited—has been formed within the Joseph Lucas (Industries), Limited, organization. It will " make, do, or provide such arrangements, things, and services " to enable the parent, associated, and subsidiary companies to be carried on economically and profitably, or to promote their success, etc. The company was registered on August 21 with a capital of £100 in £1 shares. The subscribers are Mr. F. Garner and Mr. P. A. Bristow, both of the parent company.

British Welding Research Association

Brief Summary of Establishment and Activities

The JOURNAL's representative visited Abington Hall, Abington near Cambridge, the home of the British Welding Research Association, on the day preceding the occasion of this year's "Open Day." This headquarters is very pleasantly situated in wooded surroundings, and the general set-up is not dissimilar to that of the British Cast Iron Research Association, in that administration is sited in the Hall itself with laboratory and test-house accommodated in outlying buildings, some of them quite new. Work is proceeding on a separate office building, which will provide additional accommodation for the new staff required for an expanding research programme. Also under construction is an engineering laboratory, the first stage of which will consist of an urgently needed welding shop. Both new buildings will have plastically designed steel frames.

The largest of the research buildings is the metallurgical laboratory, which houses a comprehensive range of fusion-welding equipment for the metallurgical research teams. The advisory service for members of the Association is also conducted from this building. The laboratory has a heat-treatment room containing seven furnaces, where work up to 1,350 deg. C. is carried out. Of particular interest to foundrymen is the work in hand on the preparation of radiographic standards for welds. A handbook on the classification and identification of weld defects was published by BWRA last year. This laboratory has a separate chemical-analysis department, and also an automatic large-quartz-prism spectograph and ancillary equipment.

The resistance-welding laboratory is the scene of research into the fundamentals of spot-welding, and on optimum welding conditions. Recent developments include the resistance stud-casting process, (sometimes applied to cast products) which was displayed once again this year in the hope that further suggestions might be forthcoming as to its application in industry.

A comprehensive range of tests is being undertaken in the fatigue laboratory, here, experiments include work on the properties of welded joints in aluminium alloys, and the determination of fatigue properties of manual and automatic argon-arc welds in Nimonic 75, 80a and 90. The fatigue strength of mild-steel butt welds is also under investigation, and preliminary results were set out for all to see.

Welding/Founding Liaison

In discussing with the Research Association's staff how liaison could be effected on the common problems between welding and founding, the writer was assured that the ground is well prepared. Either sponsored work from individual foundries could be undertaken or programmes could be prepared in consultation with the foundry research associations—as in fact has occurred in the past. Such subjects might include argon-arc or bronze welding of non-ferrous (and possible ferrous) materials; work on welding spheroidal-graphite cast-iron pipes, training of operators for the rectification of steel castings, or development of cast/weld manufacturing techniques for complicated components.

It was somewhat startling to learn that the welding industry has a CO_2 Process. However, this turns out to be the use of the gas as a promising (and cheap) substitute for argon in certain gas-shielded arc-welding techniques, some applied to ferrous materials.

In a separate section of the premises, tensile testing was being carried out on massive test-pieces—welded steel plates of no less than 3-in. thickness—in a 2,000-ton testing machine. (It might be interesting to employ such a machine for testing heavy-section cast parts.) Yet another device which might have a foundry application, is the trial employment at Abington of local heat-induced residual-stresses adjacent to a weld for the purpose of increasing the fatigue strength of the weld itself—sometimes by as much as 100 per cent. in some cases, it was reported.

Viewed objectively, the British Welding Research Association, since the war, has gathered together at Abington a very strong cadre of practical scientists, has built and equipped excellent laboratories and workshops and proved that it ranks in the forefront of the world's research. (Concurrently with the "Open Day," the Association's annual report was issued and no doubt can be made available to scientific authorities on application to the Association's secretary at Abington Hall.)

* * * * * *

The British Welding Research Association has just announced the formation of a new members service department, which is to combine the functions of the old liaison and publications departments. In charge of the new department is Mr. P. H. R. Lane, B.SC., A.I.M., A.M.INST.W., who was until recently deputy chief metallurgist of the Association. Mr. R. G. Burt, O.B.E., B.SC.,(ENG.), M.I.MECH.E., M.INST.W., hitherto chief development officer, remains with the Association as development consultant, while Mr. L. Parkes, is to be editor of reports and publications, including the two cover-to-cover translations of Russian monthly welding journals undertaken by the Association.

Steel Production in Western Germany

July's record steel production in Western Germany is not expected to be improved on in August. Provisional figures put the total at 2,295,179 tons, compared with 2,319,742 tons in July. Production per working day dropped from 85,916 tons to 85,006 tons. Pig-iron output, however, rose to 1,630,353 (1,606,243) tons with production per calendar day at 52,592 (51,814) tons.

Grave dissatisfaction is being expressed by the iron and steel industry of the Saar at the fact that since the first post-war price-list to be issued in German marks—it has been valid since the rejoining of the Saar to Federal Germany—the Saar ex-pit price for washed coking coal lies well above all others in the ECSC framework. Price demanded by the Saarbergwerke, the country's mining organization, is DM 68.50 (about £5 14s. 6d.). This has brought about an increase in costs to the district's iron and steel industry —which now produces some 300,000 tons of raw steel per month—of some DM 20,000,000, or about £1,670,000 per year.

Factory Equipment Exhibition

The next Factory Equipment Exhibition will be held from September 21, 1960, at Belle Vue, Manchester. New arrangements for the benefit of factory and plant management include the grouping of the several hundred different types of exhibits into their various categories. In 1961 the Exhibition will return to Earl's Court, London.

American Letter

S.-g. Iron Society completes its Organization

The Ductile Iron Society completed its organization at a recent meeting in Chicago of member company representatives, at which officers and directors were elected—Robert S. Thompson (president, H. P. Deuscher Company, Hamilton, Ohio) was chosen as the Society's first president. In his address, Mr. Thompson said that the purpose of the Society will be to represent its members in all matters of common interest in the fields of metallurgical research, product development and promotion, technical advice, and operational improvement.

Officers.

Other officers elected are: vice-president, William Beatty (vice-president, Morris Bean & Company, Yellow Springs, Ohio); secretary-treasurer, R. K. Guise (metallurgist, Kuhns Brothers, Company, Dayton, Ohio); and executive-secretary, James H. Lansing (castings consultant, Cleveland).

Directors.

The directors chosen are: Midwest Section—W. H. Shinn (Gunite Foundries Corporation, Rockford, Ill.) and W. B. Aylward (Neenah Foundry Company, Neenah, Wis); Eastern Section—Arthur Avedisian (Taylor & Fenn Company, Windsor, Conn.) and Armande Giorgio (Ductile Iron Foundry Incorporated, Stratford, Conn.); Southern Section—Niel Mingeldorf (Savannah Machine & Foundry Company, Savannah, Ga.); Southwest Section—E. C. Graham (Acme Foundry & Machine Company, Blackwell, Okla.), and West Coast Section—J. R. Ludwig (Soundcast Company, Newport Beach, Calif.).

Cast-iron Core-boxes for Shell Cores*

Shell core-boxes may be made of iron, steel, bronze, aluminium and other metals. Satisfactory results have been obtained from grey-iron core-boxes made by the author's company, using a "cast-to-size" process in dry sand with zircon facing. Pencil gates on ½-in. centres are incorporated, and the metal is poured at 1,315 deg. C. Boxes are given a normalizing treatment for 7 to 8 hr. at 510 to 595 deg. C., one to three times depending on size, to avoid distortion during machining. Grey iron is used for all shell core-boxes and shell-mould patterns, both being made by the "cast-to-size" method. The chemical composition of the grey iron used is as follows:

Carbon	320-340	6- to 9-mm. chill depth on a wedge-type specimen 1⅞ in. high by ⅛ in. base.
Silicon	220-240	
Sulphur	0.15	
Phosphorus ...	0.20	
Manganese ...	0.65	

Cast-aluminium Boxes

Cast-aluminium shell core-boxes have been used with varying results. The main objection to aluminium was that the coefficient of expansion up to 315 deg. C. differed from that of grey iron at the same temperature. If the rate of heat transfer in aluminium core-boxes was twice as rapid as that in grey-iron core-boxes, then the dissipation rate should follow the same line.

Experience has shown, however, that when using aluminium core-boxes on several shell-core machines, the machines can be operated on shorter cycles than when using grey-iron boxes, and at higher temperatures. On multiple-station machines (where six different sizes and shapes of cores were being made at the same time and temperature) some cores, because of their design, were good, whereas others having several right-angle sections were subject to insufficient cure, and peel-back occured. Warpage was encountered in the aluminium shell core-boxes after 30 days.

Cast-iron Boxes now used Exclusively

The author's company now uses cast-iron boxes exclusively. About 50 per cent. of the company's cores are now shell, made on 4 six-station, 1 two-station, and 1 one-station, units. Proper rigging of core-boxes to provide efficiency in blowing, curing and ejection of cores is of the utmost importance, regardless of whether the production rate is high or low. Cores can sometimes be made with from ½-deg. to no draft. Instead of screened vents, holes (usually about ¼-in. dia.) are drilled, and square pegs are inserted. At parting sections, slots are milled to ½-in. out of the cavity, and a hole is drilled at that point. To date, the author's company has approximately 300 grey-iron core-boxes, producing shell cores, that have been in use over the past four years. These core-boxes have been subjected to temperature variations of from ambient up to 315 deg. C. Some are in production for 2 or 3 hr., while others have been used for 24 hr. a day for six days without cooling.

Precision-cast Dies

A casting method, utilizing a mouldable graphite mixture, to produce dies with cavities cast to final dimensions has been successfully developed, the manufacturing methods division of Air Materiel Command have announced. The work was performed under contract by the Armour Research Laboratories of the Illinois Institute of Technology. By this casting process, alloys which are difficult to machine are used to make finished dies for hot-forging operations, without costly and time-consuming machining of the forging dies. High die-operating temperatures have been proved advantageous for intricate shapes, in that the forged part is not chilled as severely as in normal practice.

The final report reveals that the cast dies have been used for forging steel at an operating temperature of 870 deg. C. The casting method of producing dies was sought because, in normal forging practice, it is often difficult or impossible to produce forgings with long, thin projections that extend deep into the die cavity. These sections are difficult to form because, as the hot forged metal is forced into them, it is rapidly chilled by the cold die. D. C. Harleman, project engineer, said that where forgings with long, thin projections are required, they are usually produced with thicker rib sections than necessary for the finished product, and then machined to final size. This production method was, of course, very expensive.

Automation Congress

The Fifth International Automation Exposition and Congress will be held in New York City, at 500 Eighth Avenue, from November 16 to 20. Advance enrolment is necessary, as the number of persons who can be accepted is limited. Amongst the technical sessions planned are: "automatic control of machines"; "human factors in systems engineering"; "plant layout for automation"; and "office automation." Automation "clinics" will be held, consisting of 90-min. lectures and demonstrations based on exhibited equipment.

* Synopsis of a paper presented at the AFS Congress in Chicago, in April. The author is J. E. Stock (superintendent of foundry methods and processes at the John Deere Waterloo Tractor Works, Waterloo, Iowa).

Equipment & Supplies

Lead Bricks for Radiation Shields

A new lead brick for use in shielding personnel against Gamma, Beta and Alpha rays has been produced by a special "pressure moulding" technique by British Lead Mills, Limited, Byron House, 7/9, St. James's Street, London, S.W.1., a member of the Firth Cleveland Group. The company was approached by the United Kingdom Atomic Energy Authority, Harwell, some time ago and after a period of close liaison with Harwell a standard pressure-moulded lead brick was produced by the company at Welwyn Garden City. With lead bricks produced by pressure moulding, it is claimed that the greatest density and freedom from porosity and inclusions is ensured. The bricks are 2, and 4 in. thick, in the form of standard, corner, top and bottom bricks and also half or even quarter bricks which can be built up into a complete surround by virtue of their interlocking nature, to give the maximum thickness at any point of 2 in. or 4 in. or multiples thereof.

Metallic-lead Primer

Allweather Paints, Limited, 36, Great Queen Street, London, W.C.2, are now marketing the new Pitan metallic-lead primer, which, when applied to iron and steelwork, forms a blanket of metallic lead and seals the surface from electrochemical activity (the main cause of corrosion). The metallic lead, plus the oil in the film, also forms lead soaps, which combine to give excellent adhesion and restrict the spread of any corrosion already present on the surface being treated. The primer should be overcoated within a few weeks with one undercoat and one finisher, hard-gloss paint or enamel. Interesting features of the primer are: Drying time, six to eight hr.; film thickness of 0.001 in.; no settlement when stored, and a covering capacity of approximately 45 sq. ft. per lb.

Hard-surfacing of Impeller Blades

Metal Deposits, Limited, of 772/4, Chester Road, Stretford, Lancs., have recently been carrying out the deposition of high-grade wear-resisting alloys on impeller-rammer blades for the purposes of increasing the life expectancy of these items. The application proved completely successful and increased the life of a blade from 2 days to 4/6 weeks before a replacement was required. A notable point is that after the blades are taken out they can again be processed and put back into operation once more.

Miniature Fork-lift Truck

G. Hunter (London), Limited, 80, Fenchurch Street, London, E.C.3, announce the introduction of the Steinbock Piccolift fork-lift truck, claimed to have advantages of a sit-on rider-controlled truck and yet a length of only 37 in. Its capacity is 10 cwt. at 24 in., or 11 cwt. at 20 in., load centres. The truck is three wheeled, with an independent motor on each front wheel. Towing capacity is available up to 10 tons, and from 60 up to 138 in. height of lift can be supplied. Drive is by electric traction batteries, and cushion tyres are fitted as standard.

Mobile Casting-bogie

Mellor Mineral Mills, Limited, Etruria Vale, Stoke-on-Trent, are now marketing the Dohm-Davison mobile casting-bogie (Fig. 1). The bogie is claimed to reduce operator fatigue and labour costs, and to be quicker and safer than casting by hand-shank. It has a capacity of approximately 112 lb. of metal, and is adjustable for casting moulds up to 24 in. in height. The holding-band may be adjusted for varying sizes of crucible or ladle by means of cleats. The overall length of the bogie is 6 ft., and the wheels are 12 in. apart. The ladle is 14 in. deep, and set at its lowest point is 9 in. from the floor.

FIG. 1.—*Mobile casting bogie introduced by Mellor Mineral Mills, of Stoke-on-Trent.*

ALFRED BULLOWS & SONS, LIMITED, Long Street, Walsall, announce a new quick-release fluid-hose coupling, manufactured under licence from the Binks Manufacturing Company of America. This new coupling is compact and hard-wearing, and its push-and-turn operation is claimed to be quick and foolproof. The principal advantages offered by the coupling are (*a*) it enables the operator to make a rapid change of colours, and (*b*) the gun may be disconnected for cleaning without the necessity of "blowing back" or cleaning out fluid lines.

IN ORDER TO meet the growing demand for specialized compounds in the epoxy-resin field, Shell Chemical Company, Limited, announce that they have made arrangements whereby their proprietary compositions of this type will be made available to industry from Beck, Koller & Company (England), Limited, of Speke, Liverpool, and C. V. A. Jigs, Moulds and Tools, Limited, of Hove, Sussex. In addition, arrangements have been made for W. Pickard & Company, Limited, of Sheffield, to supply proprietary compounds based on Epikote resins to the foundry industry.

EFCO, LIMITED, Netherby, Queens Road, Weybridge, have introduced a new vertical, cylindrical closed-quench furnace for gas-carburizing and carbo-nitriding applications, involving controlled atmospheres. Electrically heated by Corrtherm elements or gas-fired with radiant tubes, it is claimed that—stemming from the choice of a cylindrical vertical shape—fuel economy of the order of 15 per cent. is possible compared with conventional horizontal rectangular furnaces.

SIMMONDS AEROCESSORIES, LIMITED, Pontypridd, Glam, have decided to extend indefinitely the scheme under which purchasers of Surform tools may return them to the manufacturers within seven days of purchase if they are not satisfied with their performance, in which case, purchase price will be refunded.

Electricity in Industry

Industrial applications of electricity for heating, space heating, and lighting were dealt with by speakers during a course for engineers of the National Industrial Fuel Efficiency Service which was held recently at the Central Electricity Generating Board School, Buxton (Derbyshire).

Speaking on "Industrial Lighting," Mr. W. Robinson, B.SC., lighting officer of the Electrical Development Association, said, "It would be misleading to suggest that increased lamp efficiency means a reduction in the use of fuel for lighting. As, through better lamps, industry goes on receiving more electric light for money spent, so lighting standards will improve and artificial lighting will extend over the working day. The real fuel saving for electric lighting will come as a result of more efficient industrial structures."

Continuing, Mr. Robinson said "However adequate might be the illumination in a factory its usefulness could be partly or completely destroyed by glare and by faulty layout of equipment. There was only one complete safeguard against glare, and that was the complete concealment of lamps at normal angles of view. Present Factory Act regulations called for a 20 degree angle of light cut-off below the horizontal, but the modern tendency was to increase this angle to 30 degrees and even more. Even so, it had to be remembered that, although reflectors might prevent direct view of lamps, the bright interiors of the reflectors could still be seen even at low angles and the most recent approach was to use aluminium reflectors so shaped that the lower part of the reflector did not appear bright to the normal observer. It was important to realize that lighting discomfort increased in direct proportion to the number of lighting fittings which could be seen at one time. For any given height of fitting, the larger the lighted area, or the higher the illumination, the greater was the number of fittings visible, and hence the greater the possibility of glare discomfort." The speaker concluded by saying in two factories the lighting and heating systems were so integrated that the heat from the lighting installation was supplying the full or major part of the space-heating requirements of large areas. There were counterbalancing problems of summer cooling, but one had to recognize that naturing lighting *via* glazing introduced the same problem without compensating winter fuel saving.

A Reminder!

Members of the Institute of British Foundrymen who intend to participate in the National Works Visits function on Friday, October 30, are reminded that the closing date for receipt of appplications is September 30. National Works Visits Day is the occasion when parties will assemble in London for a series of visits to foundries in London and the Home Counties, eight establishments having issued invitations and offered hospitality. On the same evening, the parties will re-assemble in the West End for dinner and light entertainment. Application forms are available from the secretary of the Institute, Mr. G. Lambert, at St. John Street Chambers, Deansgate, Manchester, 3; details of the arrangements were published in this JOURNAL, September 3, page 100.

INC Address Changed:

The Ironfounders' National Confederation has changed its address to 12th Floor, City Centre House, 30, Union Street, Birmingham 2 ('phone: MIDland 8427).

Firth Cleveland in USA

A new company to represent the Firth Cleveland Group in the United States has been formed in New York. Known as Firth Cleveland Incorporated, the company has offices at Lincoln Building, 60 East 42nd Street, New York. The director and vice-president is Mr. J. A. Hayward, (the son of Mr. C. W. Hayward, chairman and managing director of Firth Cleveland, Limited) and the treasurer and secretary is Mr. G. R. Bentley.

A second new company Surform Incorporated, which has been formed as a subsidiary of Firth Cleveland Incorporated, will be responsible in the USA for distribution of Surform and Surcut hand tools. Before the present re-organization, the only Firth Cleveland companies in the USA were Stenor Incorporated and Simmonds Stop Nut Corporation of New Jersey. These have now been taken over by Firth Cleveland Incorporated.

An important division of the newly-formed company will be the Firth Cleveland Steels Division, under the management of Mr. P. H. Garfunkel. This division will be responsible for the distribution in the USA of the products made in England by Firth Cleveland Steel Strip Limited, the Firth Company, Limited, Richard Hill, Limited, and Keeton Sons & Company, Limited.

Output at Sterne's

L. Sterne & Company, Limited, makers of refrigeration machinery, Hillington, Glasgow, who are the British licensees for the production and distribution of Tecumseh compressors, are making more than 2,000 of these units for refrigeration plant every day. Within the next few months, when about 60,000 sq. ft. of factory space has been added to present capacity, output is expected to be run at the daily rate of 6,000 compressors from the company's hermetic unit division.

Between 60 and 70 per cent. of the output is exported, the chief market being Canada, where 100,000 units are expected to be sold next year. The development of slot-machine self-service of fresh foods has provided a growing market for the company's Tecumseh product. Mr. Carruthers, a managing director of the firm, has also confirmed that the firm's compressors will be installed in the slot-machine service which will be operated under the recently announced arrangement between the Hawker Siddeley Group and J. Lyons & Company, Limited.

Latest Foundry Statistics

Light-alloy Castings: Belatedly, the Ministry of Supply have reported that in May the production of magnesium castings was 150 tons, a slight improvement on this year's monthly average. During this month, 7,266 tons of aluminium castings were produced, of which 1,602 tons were made from sand moulds; 3,914 tons as gravity-die and 1,750 as pressure-die-castings, again a practical gain on the average for the first five months of the year.

Building Exhibition, 1959

The Building Exhibition is to be held at Olympia, London, from November 18 to December 2, when an area of 460,000 sq ft. will be occupied by a most comprehensive display of developments in the building industry. Many countries from overseas will be participating, those exhibiting for the first time being Finland, Spain and Portugal.

Scotland retains Order for Baths

Following a protest from a Falkirk union, Kirkcaldy (Fife) Housing Committee have decided an order for baths for houses in the Dysart redevelopment scheme should be placed in Scotland rather than England. The protest came from Bailie William Ure, Falkirk, divisional organizer of the Amalgamated Union of Foundry Workers, in a letter to the housing convener, Councillor David Blyth.

The baths were ordered in July from M. Cockburn & Company, Falkirk, the order was then switched to a Hull firm. According to Bailie Ure the order was cancelled on the instruction of the town Council's architects, who apparently insisted that the baths should be obtained from Ideal Boilers Limited, Hull. Bailie Ure also said in his letter that the Falkirk firm was regarded as one of the foremost bath manufacturers in the country, and had supplied baths to the British and other Royal families. The order would provide employment for five moulders and an enameller for a week, and contribute to the employment of other workers. The baths ordered were standard, and there was no reason to suppose any advantage in either price or quality would accrue from the transfer.

Councillor Blyth said later that he felt that orders by Scottish authorities should, where possible, be placed with Scottish firms. The question of the order for the baths being transferred to an English firm had subsequently been discussed by the committee, and they had decided unanimously the baths should be supplied by the Scottish firm.

MARIA CRISTINA CHEMICAL INDUSTRIES INC. of Manila, Philippines, has started to produce ferro-silicon, ferro-manganese, and silicon-manganese, states an economic report from the Board of Trade.

General Electric Share Issue

Preference, ordinary, and unsecured loan stockholders in the General Electric Company, Limited, submitted more than 7,500 applications totalling over £43,000,000 stock for the £4,000,000 of the new 6 per cent. unsecured loan stock 1979-84 available to them. The issue was for £8,000,000, but holders of the maturing 3½ per cent. unsecured loan stock 1954-59, in accordance with their agreement, applied for £4,000,000 of the new stock. Such applications have been accepted in full.

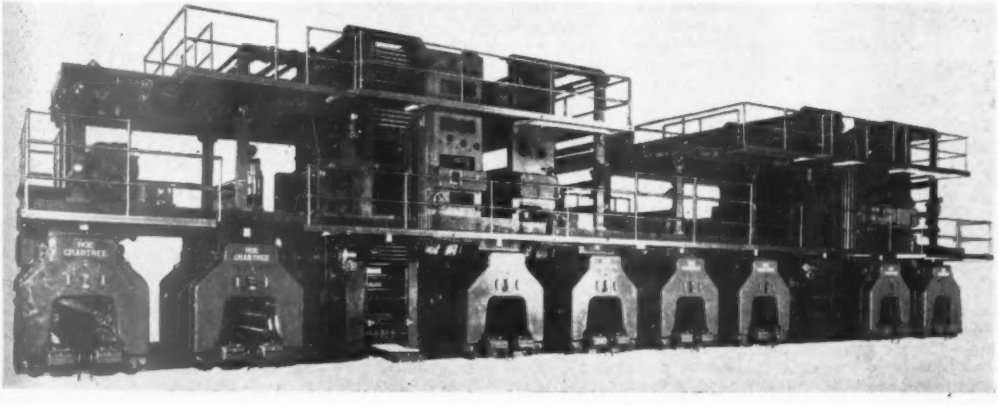
In the allotment of the £4,000,000 stock not subject to that engagement, applications for £100 and £200 stock have been allotted in full. Those applying for £300 to £50,000 stock have been allotted approximately 10 per cent. of their applications with a minimum of £200 stock; over £50,000, the allotment is approximately 5 per cent. with a minimum of £5,000. In a limited number of cases, allotments have been reduced to take into account the size of the applicants' holdings in the company.

At the company's annual meeting in London on Thursday, September 3, the chairman, Sir Leslie Gamage, said there was a definite improvement in the figures for the first two months of the current year. They knew from experience, however, that the first few months of the year were not necessarily an indication of those to follow.

GOODYEAR TYRE & RUBBER COMPANY (GT. BRITAIN), LIMITED—Mr. W. R. Booth, appointed financial director and secretary, succeeds Mr. A. H. Brundage, who has returned to the headquarters of the Goodyear Company, in Akron, Ohio, to take up another assignment. Mr. Booth was previously managing director of Goodyear-Cuba.

Newspaper Presses for New Zealand

An order for two newspaper presses for the publishers of the New Zealand Herald *will be completed shortly by R. Hoe & Crabtree, Limited, of London, S.E.1, when the second of the "Supercolour" rotary presses is installed. Each press consists of eight units with two single-double former folders, three arm-magazine roll-stands with flying pasters, and two rack-back multi-colour units. The publishers who ordered the presses are Wilson & Horton, Limited, who have built a new building in Auckland to house the presses. Each of the press units and folders is shipped in a completely assembled state. A special lifting beam, which is bolted across the top of each unit and has a single lifting eye for attachment to the crane hook, has been constructed. Each unit (weight 15 tons) is lifted on to a cast-iron base plate, bolted down, and then the whole lifted into a packing case. The total weight of each packed unit is 16 tons.*



Personal

Mr. J. E. ROBSON, a local director of Samuel Osborn & Company, Limited, has been appointed a director.

Dr. ALAN LLOYD DAVIES has been appointed to a Lectureship in Metallurgy at the College of Advanced Technology in Birmingham.

The Earl of HALSBURY has been appointed scientific consultant to the research department of Davy & United Engineering Company, Limited, Sheffield.

Mr. B. M. HARDMAN, a partner in Trent Laboratories, metallurgical consultants, Stoke-on-Trent, has been elected a fellow of the Institution of Metallurgists.

Mr. H. M. TAYLOR, a director of R. W. Crabtree and Sons, Limited, has been invited to address the Metal Decorators' Convention in New Orleans, to be held from October 12 to 14.

Mr. CHARLES H. T. WILLIAMS, managing director of the Park Gate Iron & Steel Company, Limited, Rotherham, has been elected senior warden of the Cutlers' Company in Sheffield.

Mr. H. C. HORSUP, secretary of Ransomes & Rapier, Limited, having reached retiring age, will retire after nearly 40 years' service on September 30. He will be succeeded by Mr. G. N. RODGERS.

Mr. F. S. WOODWARD has been appointed secretary of the Consett Iron Company, Limited, and will take up the appointment on December 1. He is at present secretary of Round Oak Steel Works.

Mr. Iain Macleod, Minister of Labour and National Service, has appointed Mr. H. W. EVANS to be his Principal Private Secretary, in succession to Mr. D. R. F. TURNER, who is transferring to the Cabinet Office.

Mr. L. P. LEE has been appointed to succeed Mr. A. V. WILKIN as chairman of the British Internal Combustion Engine Manufacturers' Association for the coming year. Mr. H. DESMOND CARTER becomes vice-chairman.

Mr. R. YEOMAN, general manager of the Hodgkinson group of foundries has been elected a director of the parent company, James Hodgkinson (Salford), Limited, mechanical-stoker manufacturers, Ford Lane Works, Pendleton, Manchester.

Dr. W. D. SCOTT has been appointed managing director of BTR Industries, Limited, from October 1. He will succeed Mr. P. W. HOWARD, who is relinquishing that position but will remain a director and deputy chairman of the company.

Mr. WILLIAM SUTTON who had been works manager for 20 years at Wellman Smith Owen Engineering Corporation, Limited, Willenhall, received presentations from the directors, staff and workpeople on his retirement after 32 years' service with the company.

Sheepbridge Equipment, Limited (foundry division), and Sheepbridge Alloy Castings, Limited—two subsidiary companies of the Sheepbridge Engineering group—announce the appointment of Mr. J. E. PEARSON of "Whitecroft," Whinney Lane, Langho, near Blackburn, as an additional Lancashire area sales representative.

The European Coal and Steel Community announce that the new president of the High Authority is Mr. PIERO MALVESTITI, hitherto vice-president of the Common Market Commission, and the two vice-presidents are Mr. DIRK SPIERENBURG and Mr. ALBERT COPPE, who held the same appointments in the previous High Authority. The new appointments are for two years.

After 27 years service with Aga Heat, Limited, Mr. P. R. LUNN has resigned and taken a position with OTMA, management training consultants, Little Russell Street, London, W.C.1. During his period with Aga Heat, no fewer than 700 representatives attached to the firms agencies attended his lectures. Mr. Lunn was the recipient of parting gifts at a reception recently held at Orchard House, London.

Mr. W. J. STRAKER-SMITH, Mr. JAMES M. JARDINE and Mr. C. E. HUNTER have been appointed to the board of Smith's Dock Company, Limited, as from October 1. Mr. Jardine is secretary of the company, and Mr. Hunter, manager of the company's South Bank shipyard. Sir TRISTRAM EDWARDS is to retire from the board on September 30, after 57 years' service—45 as a director. He will remain honorary president.

Mond Nickel Company, Limited, announce that the development branch of the company's Development and Research Department has recently been reorganized into four divisions under the general managership of Mr. F. DICKINSON, a director of the company. The divisions are as follow:—Ferrous division (manager, Mr. W. W. BRAIDWOOD); non-ferrous division (manager, Mr. J. HINDE); applicational engineering division (manager, Dr. A. B. EVEREST), and general division (including plating, chemical products and nuclear power) (manager, Dr. E. C. RHODES). Mr. L. W. JOHNSON, at present assistant manager of the Department, having reached retirement age, will relinquish his appointment at the end of September.

Obituary

Mr. PAUL SUURKIVI, senior design engineer in the research division of the Brush Electrical Engineering Company, Limited, Loughborough (Leics), has died at the age of 44.

The death has occurred of Mr. ELLIS SHACKLETON, who for the past nine years had been sales manager of Dean, Smith & Grace, Limited, lathe and tool manufacturers, Keighley. He was 58 years of age.

The death took place on Thursday, September 3, of Mr. TOM HOPES, senior assistant engineer manager at the Southampton repair department of John I. Thornycroft & Company, Limited. He was 57. Mr. Hopes joined the company in Singapore in 1935 and went to the repair department in 1942.

Mr. ROGER WALCOTT NEWBERRY, a former assistant manager of Ruston-Bucyrus, Limited, Lincoln, has died in North Carolina, USA. He was among those who came over from the States in 1929 to discuss the formation of the company. He resigned his Lincoln appointment in 1940 and returned to the parent company, the Bucyrus Erie Company, of South Milwaukee, United States, of which he became vice-president.

The death is announced, in the French Press, of Mr. GASTAVE RIVOIRE, a past-president of the *Association Technique de Fonderie*. He was on the staff of Delattre et Frouard, but was best known for his pioneer work on the development of light alloys. He was an ex-student of the Paris foundry college, being one of its early entrants. During the 1914 war he was awarded both the *Médaille Militaire* and the *Croix de Guerre*. For his work in the training of foundry personnel he was made a Chevalier of the Legion of Honour. He was 68 years' old.

News in Brief

THIS YEAR, the Danish Foundry Employers Association has celebrated the 40th year of its incorporation.

THE *Bureau International de la Récupération* (B.I.R.), announces that the annual congress will be held in Düsseldorf from October 27 to 29.

UNITED DOMINIONS TRUST, LIMITED, announce the opening on September 21, of a new branch office at 7/9, Cowgate, Peterborough, Northamptonshire.

NORTHAMPTON DEPOT of British Insulated Callender's Cables, Limited, from September 28 will be at 18/22, St. George's Street. The telephone number (Northampton 1860) is unchanged.

AVIATION ELECTRIC, LIMITED, Montreal, PQ, has been appointed exclusive distributors for the Dominion of Canada of the engine-protection equipment of Teddington Industrial Equipment, Limited, Sunbury-on-Thames (Middx).

ULTRASONOSCOPE COMPANY (LONDON), LIMITED, Sudbourne Road, Brixton Hill, London, S.W.2, have recently delivered to India the first automatic test rig for the ultrasonic inspection of turbine discs. It is said to be the first unit of its kind to be supplied to that country.

THE INSTITUTE OF WELDING announces that Professor N. N. Rykalin, Dr. techn. sci., corresponding member of the USSA Academy of Sciences, will lecture at the School of Welding Technology on September 29 and 30, and at the special meeting on "Electro-Slag Welding" on October 1.

STANTON IRONWORKS COMPANY, LIMITED, near Nottingham, has received an order, valued at approximately £250,000, from the East Midlands Division of the National Coal Board, to supply cast-iron tubbing-rings for the lining of two shafts at the new Cotgrave Colliery, Nottinghamshire.

THOS. W. WARD, LIMITED, Sheffield, have despatched the first consignment, weighing 40 tons, of parts for four dockside cranes for Casablanca. Each crane weighs 80 tons. It is dismantled and needs seven lorries to transport it. The total load of 320 tons is being moved in 28 loads.

BOROUGH POLYTECHNIC, Borough Road, London, S.E.1. announce a special lecture course on "Refractories, their Manufacture Properties and Uses." There are to be ten weekly lectures beginning on Friday October 9, at 7 p.m. Details are available from the secretary, Mr. Fredk. J. Packer.

MR. W. E. A. REDFEARN, managing director of English Steel Corporation Limited, Sheffield, gained five awards at the 15th annual garden-produce show of the firm's sports club at their pavilion in Bellhouse Road, Sheffield. Mr. W. Searston, a works manager, won the Directors' Trophy for most points. There were 200 exhibits.

THE BRITISH COAL UTILISATION RESEARCH ASSOCIATION announce that the eighth Coal Science Lecture—"Coal: a Colloid and a Chemical"—will be delivered by Sir Eric Rideal, F.R.S., in the Lecture Theatre, Institute of Civil Engineers, Great George Street, London, S.W.1, on October 14, at 5.30 p.m. Admission will be by ticket only.

A SPECIAL COURSE for social and sports clubs secretaries in industry is being held at Lilleshall Hall, Shropshire, from October 5 to 9. It is being sponsored jointly by the Central Council of Physical Recreation and the Industrial Welfare Society, and the programme will consist of lectures and discussions on the role of the industrial club and the sports officer's job.

FOLLOWING THE REDUCTION of British Railways' requirements of wagons and the decision of Hurst, Nelson & Company, Limited, Motherwell, to cease production, the company's plant has been acquired by George Cohen, Sons & Company, Limited, a member of the George Cohen 600 Group, Limited. Various individual items will be offered for re-use in industry.

A FURTHER order for the latest Leyland buses with fully-automatic gearchange has been placed by the Department of Government Transport, New South Wales. The new contract covers 50 Leyland Royal Tiger Worldmaster single-deck buses similar to the 156 ordered by the Department last year, making a total of some £1,300,000 invested with Leyland Motors, Limited in this type of bus.

THE INSTITUTION OF PLANT ENGINEERS announces that the next of their comprehensive refresher courses for senior works and plant engineers, comprising 18 weekly lectures on Thursday evenings, will commence on October 29, at Leeds University. The fee for the course is four guineas, and full particulars may be obtained from the secretary to the refresher course, Department of Engineering, The University, Leeds, 2.

REGROUPING of its central-heating interests within a single company—Bratt Colbran, Limited—is announced by Radiation, Limited. Bratt Colbran is now responsible for Ductair warm air central-heating equipment and Ascot central-heating boilers, as well as other methods of central heating now being developed. Mr. Frank Davies has been appointed general home sales manager and Mr. C. A. F. Bennett, sales manager, central heating.

THE FORFEIT FEAST of the Cutlers' Company is to be held at the Cutlers' Hall, Sheffield, on September 25, and amongst the guests will be the Duke of Devonshire; the Master of the Worshipful Company of Cutlers in London, Mr. G. V. Thomson; the Master of the Worshipful Company of Armourers and Brasiers, Mr. W. Pontifex; the Lord Mayor of Sheffield, Alderman A. V. Wolstenholme; and the Bishop of Sheffield, Dr. Leslie Hunter.

A PROPOSAL TO TAKE CONTROL of one of the largest French manufacturers of motor accessories—Auto-Coussin Dura—is being considered by Wilmot Breeden, Limited, Birmingham manufacturers of similar products. Auto-Coussin Dura, a private company which had a turnover of £8,500,000 last year, claims to control half of the French market for car door accessories and panel windows, 20 per cent. of the market for car seats, and 10 per cent. for spring mattresses. The company has no subsidiaries elsewhere in France or abroad.

SIX MEN working on a cupola furnace at the works of the Brightside Foundry & Engineering Company, Limited, Sheffield, last week, were affected by carbon-dioxide fumes. All but one of the men—who were trying to release a blocked pipe—managed to climb down in time. Mr. John Beever (64), who is in charge of the steelworks' medical room, climbed 87 ft. to a narrow ledge to the unconscious chargehand, Mr. Harry Wilson. After giving artificial respiration for 20 minutes on a ledge only 18-in. wide, Mr. Beever managed to save Mr. Wilson.

FOUR-DAY EXHIBITIONS illustrating the properties and uses of nickel and its alloys are to be staged by Henry

News in Brief

Wiggin & Company, Limited, at the Imperial Hotel, Temple Street, Birmingham, from October 6 to 9, and at the Midland Hotel, Manchester, from October 12 to 15. Throughout the period of the exhibitions the company's technical service staff will be available to answer visitors' queries. The exhibitions will be augmented by a series of lectures and the continuous showing of films dealing with the use of Wiggin alloys to answer the many problems met in modern industry.

CALLS FOR TENDERS issued by the Export Services Branch of the Board of Trade, Lacon House, Theobalds Road, London, W.C.1, include one from South Africa for the supply of cast-iron sluice valves and cast-iron fittings for asbestos-cement pipes. Closing date, September 25, BOT reference numbers, ESB/21348/59 and ESB/21349/59 respectively. Tenders are also invited for a shot-blast machine to be supplied to Atbara (Sudan), closing date October 19, reference ESB/20253/59. Full particulars of specifications may be obtained from the Board of Trade at the above address quoting the reference numbers.

THIS YEAR there were 830 entries at the sixth annual horticultural show of Park Foundry (Belper), Limited, (Derbyshire). The show was opened by Mr. W. A. Ballard, managing director, and Mrs. Ballard presented the principal awards. The Park Foundry championship bowl and tankard for the most points in the fruit, flower and vegetable sections were won by Mr. K. Newton, who also received a special prize for the most points in the flower section. Miss Ivy Gilson won the silver salver for the most points in women's classes. A blue ribbon for the best exhibit went to Mr. A. Wright, who was also awarded a floral art diploma for the best arrangement of flowers.

UNIVERSAL ASBESTOS MANUFACTURING COMPANY, LIMITED, announces that it has acquired the entire share capital of Chancery Insulations, Limited. Mr. P. A. Lawrence, former director and general manager of Chancery Insulations, has been re-appointed executive director. Mr. D. Kirkness and Mr. P. Talbot-Smith, managing director and sales director, respectively, of the parent, Universal Asbestos Manufacturing Company, Limited, and Mr. N. C. Martin are the other members of the new board. The offices of the new subsidiary will be transferred on October 5 from 93-94 Chancery Lane, London, W.C.2, to the group's London office at 8, Upper Grosvenor Street, W.I.

GAS CONSUMERS in Whitby, Yorkshire, will be using soon a supply of natural gas found 4,000 to 5,000 ft. below the surface of Whitby Moors, it was said by Dr. R. S. Edwards, chairman of the North Eastern Gas Board, at the Conference of Yorkshire Urban Councils' Association at Scarborough on September 10. The gas was found during a survey carried out by the Gas Council together with the British Petroleum Company. Dr. Edwards said the supply would begin to householders by late summer or autumn next year. It was the only supply of natural gas which had been found although there are good supplies under the North Sea. He added, "But although we can drill wells in the sea, there is the question of to whom the gas belongs." There is a possibility that the Whitby Moor supply might, after a provisional period, be extended to other parts.

STOCKTON CORPORATION HEALTH COMMITTEE at a meeting on September 7, decided to inform Head, Wrightson & Company, Limited, at Stockton, that they expected something to be done about the atmospheric pollution from the company's steel foundry within three months. The decision was taken following a number of reports of "orange-red clouds of dust," and the report of the Chief Public Health Officer that on a number of days in June, there had been considerable pollution during many hours of the day. In a letter to the Committee, the firm stated "it certainly is our intention to instal equipment to deal with the fumes, and investigations of different methods have been in progress for some time. Immediately following the holiday, a further meeting will be held and we will communicate with you again." The Committee, however, feels that it is now a matter of urgency and have acted accordingly.

Machine Tool Exhibition

The Sixth European Machine Tool Exhibition is being held in Paris this year, from September 12 to 21. The following displays are of particular interest to founders:

DESOUTTER BROTHERS, LIMITED, are being represented by their French agents: Outils Pneumatiques Globe. Four new portable pneumatic power tools are on display.

PECO MACHINERY SALES (WESTMINSTER), LIMITED (*Stand* 1C9) exhibits include one of their pressure die-casting machines (Model 40 DC5), and demonstrations are also being carried out in conjunction with a Hedin electrical melting and moulding furnace.

TRIULZI (*Stand* 3E21).—A range of Castmatic hot- and cold-chamber die-casting machines are being shown. Technical representatives from Milan who are present will discuss the latest developments in die-casting techniques. (Baker Perkins, Limited, are manufacturing the Triulzi Castmatic range in England).

New Catalogues

Wet Dust-arrestors. Midland Heating and Ventilation Company, Limited, Bedford Road, Birmingham, 11, in a four-page leaflet describe and illustrate several foundry dust-extraction units the company has installed. One picture shows four of a battery of ten of these units working in a large mechanized foundry and another—a 30,000 cub. ft. per min. Midac unit operating on the heavy shake-out of a ferrous foundry.

Adhesive and Binder Resins. In Data Book No. 1, British Resin Products, Limited, Devonshire House, Piccadilly, London, W.1, summarize in eight tables the properties of Cellobond adhesive, laminating, and polyester foundry resins. Further sections cover grinding-wheel and brake-lining resins, and the final parts cover polymers and rubber compounding resins. Enclosed with the brochure is a postcard for the use of those requiring detailed information for any of these products.

Cut-wire Abrasive. Leaflet CSB 100, issued by the Conveyor and Shotblast Company, Limited, Leighton Buzzard, Beds. (one of the Foundry Equipment group of companies) covers the potentialities of a high-carbon-steel cut-wire abrasive. It is known as Cyldac and is available in five grades, ranging in diameter from 0.063 to 0.016 in. (1.6 to 0.4 mm.). It is made from 100 to 140 tons per sq. in. high-carbon steel wire and the length of the cut cylinders is made the same as the wire diameter in each case. It is claimed that 2 lb. of this abrasive is consumed in treating a ton of thin flat iron castings, a consumption which rises to 3 lb. for medium-size steel castings.

Baker Perkins Foundry Machinery at work.....

at R. & A. Main Ltd.

R. & A. Main Ltd. use this 'Medium' Rotary Table Shot Blast Machine for a wide range of application at a high production rate. The special control desk includes signal lights, 24 volt current socket for inspection and ammeters indicating the shot output of the patented bi-phase impellers. The wiring circuit is arranged for automatic operation to cut out human errors.

Please write for further details to:

Baker Perkins Ltd *Foundry Machinery Division*

Bedewell Works · Hebburn on Tyne · England *Tel: Jarrow 89712M* BP/F2

HISTORICAL NOTE

R. & A. Main Ltd. were established in Glasgow in the 1870's. Following the amalgamation with Thomas Glover & Co. Ltd. in 1897, extensive sites were acquired at Edmonton and Falkirk. They produce a wide range of domestic appliances including the 'Century' gas cooker, the 'Century' gas heater and the Main No. 36.c. Refrigerator — the first to carry a ten year guarantee.

Raw Material Markets

Iron and Steel

The recent figures issued by the Iron and Steel Board revealed a marked increase in the demand for castings from many consumers, and production was, in fact, 6 per cent. higher in the second quarter of the year as compared with the first three months. Many establishments are sharing in the increased level of production, including the light foundries. There is a better call for castings for the domestic utensil trade, while the same applies to builders' castings. Most of the jobbing foundries are able to produce steady outputs. Taken all round, production among the various foundries is considerably above the level prevailing during most of last year, although there is, of course, a long way to go before the industry is fully engaged.

The motor vehicle trade continues to make substantial demands for high-duty castings and some other consumers are also making heavy demands on the engineering and speciality foundries. More active conditions in the machine-tool trade are reflected in bigger tonnages of castings being absorbed, while the needs of the steel industry have been stepped up of late. The foundries catering for railway equipment are still short of work.

Pig-iron continues to be available promptly. Outputs generally exceed consumption and most producers have fairly heavy stocks on hand. The low-phosphorus grades receive the most attention, but makers are able to meet all demands, as are the producers of hematite and refined irons, while high-phosphorus iron presents no problem.

Increased business for small bars and light sections continues to be reported by the re-rollers, who are thus able to maintain their outputs at the improved levels noted in the past few weeks. A heavy demand persists for reinforcing rods, while home steelworks are absorbing larger quantities of steel semis. Most of the re-rollers have insufficient stocks of billets, blooms, etc., to meet the present level of demand and are meeting with difficulty in getting prompt delivery from the steelworks. Arisings of suitable defective steel semis and shorts at the steel plants are now readily accepted by the re-rollers.

Non-ferrous Metals

Copper is a sensitive market on both sides of the Atlantic. Recent strength of the market had been derived from the strike in the US copper industry, which has paralysed about 75 per cent. of American production, together with the belief that the industry would remain strikebound for a relatively long time. The undertone was also shored up by unsettled labour relations in Chile, the threatened longshoremen's strike scheduled for the end of this month, and the accumulated effect on the economy of the steel strike.

These bullish influences pushed up the price of copper in New York and London, although the basic determining factor—demand—was only satisfactory. In New York, after the custom smelters had posted a new price of 33 cents a pound, the producers followed suit and most of them are now quoting 31½ cents a pound, a rise of 1½ cents a pound over the previously ruling level. In London, the LME quotation was edging steadily towards £240 a ton. The London price also had the benefit of stocks falling by as much as 1,031 tons—the largest fall in any one week this year—all in all, the market looked brighter than for some time.

However, rumours began to fly this week and quickly blunted the market's sharp revival. First of all it was said that the US steel strike would be settled before the arrival of Mr. Kruschev and this was linked together with a changing opinion about the possibilities of the longshoremen's strike. Finally, after official statements from the International Union of Mine, Mill, and Smelter Workers to the effect that no attempt had been made by either side to resolve the dispute, the union made a conciliatory move over the weekend which has been interpreted by the companies involved as "a ray of hope." This was enough for most potential buyers and at the beginning of this week the market dropped as much as £10 a ton before recovering £4 2s. 6d. a ton.

The situation is, therefore, in the melting pot once again. If the reported resumption of wage talks at Anaconda are successful and the longshoremen's strike is settled or postponed, the copper price will sink. In the longer run, however, settlement of the steel and copper strikes will aid industry's push to get into top gear and the price will resume its upward course.

If no settlement is reached in either the copper or steel industries and the longshoremen's strike takes place, the price of copper on both sides of the Atlantic may well go much higher and much faster than most observers anticipate at present. Stocks of refined copper in LME warehouses fell again last week and now stand at 14,633 tons, a drop of 300 tons.

Tin remains quietly steady, with day-to-day demand in London fluctuating more than the price. Advices from the East have, on the whole, been favourable and there has been a quiet demand coming in from the Continent. The tin market has been little affected by the rumours that a settlement of the steel strike is not far away and the fact that stocks showed a rise last week of 708 tons and now total 8,537 tons. In the US the market is quiet, with the price fluctuating narrowly around $1.02½ a pound. The only item of interest outside the main market comes from Indonesia, where it is reported that the Indonesian Minister for Development has said that the Government had embarked on a plan to process her own tin in order to be independent of smelters in foreign countries. The domestic processing of the metal is planned to coincide with the expiration in May next year of a tin exploitation contract between the Indonesian and Dutch governments.

In spite of about 45 per cent. of US production of refined lead being idle, lead remains decidedly weak both in London and in New York. Demand in London is only fair and, with plenty of metal about, the price is not far off its former resistance level of £70 a ton. In the US the New York spot price is quoted at 13 cents a pound.

Zinc remains steady and, although easier market conditions have prevailed recently, this is a sympathetic movement with that of copper and belies the strong undertone. In the US the East St. Louis spot price is unchanged at 11 cents a pound.

Production Exhibition

The next Production Exhibition, the fourth in the series, will be held in the National Hall, Olympia, London, from April 25 to 30, 1960. A number of conferences, organized by the British Productivity Council with the title "Productivity, Men and Methods," will be held during the Exhibition.

Chamberlain Industries, Limited, of Staffa Works, Leyton, London, E.10, announces the appointment of Mr. G. E. HART as technical sales director of the company.

Electrical Aids in Industry *Data Sheet* **No. 6**

Lighting -1

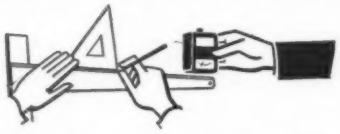
Good lighting affects productivity in three ways, (1) by directly increasing the speed of working and reducing errors and wastage, (2) by improving overall factory efficiency through better supervision and housekeeping, (3) by providing better working conditions, thus improving labour relations and avoiding frequent changes of workpeople.

It is not possible to judge by the eye alone whether the lighting in any factory is good enough to serve these purposes because the eye has a tremendous range of adaptation (vision of some kind is possible within an illumination range of 1,000,000 to 1) and is hence an unreliable measuring instrument. Severe mental and eye strain or unconscious slackening of working speed may occur under lighting which *appears* to be adequate.

The only reliable way to appraise factory lighting is to conduct a lighting survey using a lightmeter an inexpensive instrument which measures the actual illumination available. These figures can then be compared with official recommended values for the various tasks.

NATURE OF WORK, PROCESS OR MATERIAL	ILLUMINATION LUMENS/SQ.FT.
Rough or routine work. Large detail. Medium to light material of good contrast.	7
Ordinary work usually involving workers' inspection. Medium detail and contrast.	15
Skilled work, small detail or dark material.	30
Fine or critical work, very small detail, very poor contrast or very dark material.	50
Very fine exacting work.	100

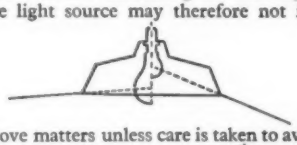
In addition, readings should be taken at selected working points with the lightmeter so placed that it measures the light



on the work while the operative is working. This will indicate whether full use is being made of the light or whether shadow is obscuring part of it.

Glare

Any direct light on the eye tends to reduce its sensitivity—thus reducing the power to see. Increasing the intensity of the light source may therefore not improve matters unless care is taken to avoid glare either by correct positioning or by the use of correctly matched reflectors and lamps.



Shadows

Unnecessary shadows may seriously slow down work and also cause accidents. Lightmeter readings should always be taken under conditions exactly similar to those obtaining while work is going on. The operative himself may mask his work, an overhead crane or a heavily loaded conveyor belt may periodically obscure a light fitting, or a dust-laden atmosphere may reduce the designed lighting values.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Telephone: TEMple Bar 9434

Excellent reference books are available on electricity and productivity (8/6 each or 9/- post free)—"Lighting in Industry" is an example.

E.D.A. also have available on free loan a series of films on the industrial uses of electricity. Ask for a catalogue.

7659-4

CUT HERE

Current Prices of Iron, Steel, and Non-ferrous Metals

(*Delivered unless otherwise stated*)

September 16, 1959

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P, 6-ton lots or over, £23 5s. 0d., delivered Birmingham, £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.: North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent., 6-ton lots or over: N.-E. of England (local iron), £24 14s. 0d.; Scotland (Scotch iron), Zone S.1, £25 0s. 6d.; Sheffield, £26 2s. 6d.; Birmingham, £26 11s. 6d.; Wales (Welsh iron), £24 14s. 0d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire, in 6-ton lots or over.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered*)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £40 0s. 0d. to £42 10s. 0d., scale 15s. 0d. per unit; 75 per cent. Si, £54 0s. 0d. to £57 10s. 0d., scale 15s. 0d. to 16s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 12s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 15s. 6d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £77 0s. 0d. to £81 0s. 0d., basis 60 per cent., Cr, scale 26s. 0d. to 27s. 6d. per unit; over 6 per cent. C, £74 10s. 0d. to £77 10s. 0d., basis 60 per cent. Cr, scale 26s. 0d. to 27s. 6d. per unit; 2 per cent. C,* 1s. 7¼d. to 1s. 10¼d. per lb. Cr.; 1 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 0.15 per cent. C,* 1s. 9d. to 2s. 0d. per lb. Cr; 0.10 per cent. C,* 1s. 9¼d. to 2s. 0¼d. per lb. Cr; 0.06 per cent. C,* 1s. 9¾d. to 2s. 0¾d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £245 0s. 0d.; 96/98 per cent., £275 0s. 0d.

Ferro-columbium.—65/72 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £66 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 6 to 35 tons, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), under 10 tons, £34 17s. 0d.; silico-manganese, under 10 tons. £43 16s. 6d.; free-cutting, under 10 tons, £36 14s. 6d. SIEMENS MARTIN ACID (under 10 tons): Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (under 10 tons).—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

* Average 68–70 per cent.

FINISHED STEEL

Heavy Plates and Sections (under 10 tons).—Ship plates, (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £67 4s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 4s. 0d.; nickel-chrome-molybdenum, £111 17s. 0d., in lots of 5 tons to under 10 tons.

NON-FERROUS METALS

Copper.—Cash, £225 5s. 0d. to £225 10s. 0d.; three months, £226 10s. 0d. to £226 15s. 0d.; settlement, £225 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 3½d. per lb.; rods, 248s. 6d. per cwt. basis; 20 s.w.g., 283s. 6d. per cwt.

Tin.—Cash, £793 0s. 0d. to £793 10s. 0d.; three months, £793 0s. 0d. to £793 10s. 0d.; settlement, £793 10s. 0d.

Lead (Refined Pig).—Second half September, £70 10s. 0d. to £70 15s. 0d.; second half December, £71 15s. 0d. to £72 0s. 0d.

Zinc.—Second half September, £85 15s. 0d. to £86 0s. 0d.; second half December, £84 15s. 0d. to £85 0s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £121 7s. 6d.; rolled zinc (boiler plates), all English destinations, £119 2s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £101 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10⅝d. per lb.; sheets to 10 w.g., 202s. 6d. per cwt.; wire, 2s. 8⅛d.; rolled metal, 202s. 6d. per cwt.

Brass (Brazing).—BS1400, B3, £152; B6, £197.

Brass (High Tensile).—BS1400, HTB1, £184; HTB2, £197; HTB3, £210.

Gunmetal.—BS1400, LG2, £188; LG3, £197; G1, 1% £249; G1, 1½%, £237.

Phosphor Bronze.—BS1400, PB1 (AID released), £286; BS1400, 90/10/1, £270.

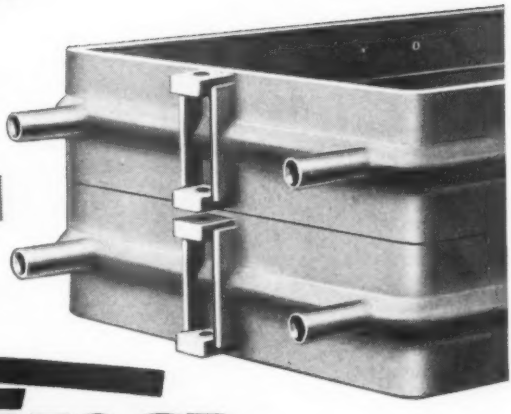
Leaded Phosphor Bronze.—BS1400, LPB1, £206.

Phosphor Bronze Strip, etc.—Strip, 290s. 9d. per cwt.; wire, 4s. 1⅛d. per lb.; rods, 3s. 4d.; tubes, 3s. 4d.; chill cast bars: solids 3s. 3⅜d.; cored 3s. 4⅜d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 10½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 3½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 2½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £71 10s. 0d. to £72 0s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £233; AB2, £246.

LIGHTNESS
STRENGTH
ACCURACY
DURABILITY



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13, Rumford St.,
Central 1558

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93, Hope Street,
Central 9969

Company News

Though the year ended March 31, 1959, was most difficult for several of the major activities of the George Cohen 600 Group, Limited, particularly the machine-tool and steel stockholding businesses, generally order-books of the group are now healthier and trends are better, states the chairman, Mr. Cyril M. Cohen.

Industrial relations based on mutual trust and understanding; stability of prices; the right of private enterprise to get on with its job unfettered by a multitude of controls, and unequivocal freedom from threats of nationalization are fundamental to the continued growth of the country's prosperity and economic well-being.

While the marked improvement in the figures for the first four months of the current year are encouraging, the chairman does not feel justified at this stage in predicting a very material change in the level of profits for the present year. Group net profit contracted to £657,739 (£817,177) and the dividend is unchanged at 12 per cent. Turnover fell 15 per cent. from £32,700,000 to £27,660,000 and there was a narrowing of profit margins.

GEO. WILSON GAS METERS, LIMITED—Contracts obtained for the sale of gas meters for the current year are 30 per cent. higher in terms of quantity than last year, although at somewhat reduced prices, says the chairman, Mr. W. D. Wilson. He says he feels confident that the accounts for 1959-60 will show a definite improvement, but the full effects of the drastic reorganization now in progress will not be felt before 1960-61.

THOMAS BLACKBURN & SONS, LIMITED, structural and general engineers, etc., of Preston (Lancs)—There is no preference dividend for the half-year to September 30, 1959. In accordance with the terms of the moratorium, the company has made a first distribution to its creditors of 4s. 3d. in the £. The minimum payment was £10. The board is working in close collaboration with the Creditors' Committee. Further distributions will be made as soon as funds become available from the orderly realization of the company's assets, it is stated.

HILGER & WATTS, LIMITED, scientific instrument makers, of London, N.W.1—The interim dividend is being maintained at 5 per cent. for the year ending September 30, 1959. The chairman states that in declaring the interim the directors have in mind the information given at the annual meeting to the effect that the company was experiencing a recession in orders received which must have an effect on the trading results of the current year. The rate of ordering over the past month has been high, he says, and the order-book is now at a satisfactory level. The 1957-58 effective total of 15 per cent. included a 2 per cent. special interim for the current year.

WILMER LEA FOUNDRIES (HOLDINGS), LIMITED—The chairman, Mr. S. A. Clark, states that the ironfoundry business has been in a desperate situation for some time and this, he adds, adequately describes the conditions which are still being encountered. The relaxation of the credit squeeze came too late to help the company during the year ended March 31, and is even now only just beginning to be felt. Although there is some improvement in the demand for iron castings, it is not yet within measurable distance of the pre-recession level. The board has taken all possible steps to prevent further losses, and the plant is operating on a five-day week and is achieving breakeven or a little better on current trading.

National Gas & Oil Engine Programme

Major modernization programme at the works of the National Gas & Oil Engine Company, Limited, at Ashton-under-Lyne (Lancs) is to involve a section of the works being completely reorganized and considerable spending on plant and new equipment to produce a more compact range of products. The company is a member of the Hawker Siddeley Group, Limited, through the Brush Group, Limited.

For the past few years the new additions in the National Gas & Oil Engine range have been running in parallel with the older designs of products. It has now been decided to withdraw certain of the old-design engines from the production range. Special consideration has been given to the provision of a comprehensive spares and service organization for these engines, which will cater for customers' requirements for many years to come.

The National Gas & Oil Engine factory will operate as a completely separate unit in the Hawker Siddeley industries division, but will be backed by a new research and development centre now in an advanced stage of preparation. This will serve the company and its associate, Mirrlees, Bickerton & Day, Limited, Stockport.

Wagon Repairs' Business

With the gradual disappearance of wooden wagons, less capital may be required by Wagon Repairs, Limited, Birmingham, the annual report states. If, when the position becomes clearer, this proves to be the case, members will receive proposals for the distribution, as special dividends or otherwise, of the unrequired surplus or reserves.

During 1958-59 the volume of repair work on railway-owned stock was severely restricted, new all-steel wagons having largely displaced older wooden ones and, although the company handled at its main works about the same number of wagons as in the previous year, the extent of repairs required was greatly reduced.

Group net profits rose from £314,691 to £385,462 in 1958-59, but the progressive reduction in the number of wagons available for repair at outstations has continued since the year-end and the directors expect the current year's profits to show a substantial reduction. The 20 per cent. dividend represents an effective increase of 2 per cent. on the larger capital.

Recent Wills

Will of Sir Ashley Skelton Ward, published last week, showed that he left £54,471 gross, £51,293 (net duty paid, £16,896).

Sir Ashley, who died on March 26, aged 81, was president of Thos. W. Ward, Limited, Sheffield, chairman and former managing director of the Park Gate Iron & Steel Company, Limited, vice-chairman of the Laycock Engineering Company, Limited, a local director of the National Provincial Bank, Limited, and the Liverpool & Globe Insurance Company, Limited, and chairman or a director of other companies. He was Master Cutler in 1939-40. During the last war Sir Ashley was appointed Director of Iron and Steel Supplies, Ministry of Supply. He was a former president of the National Federation of Scrap Iron, Steel and Metal Merchants.

TIDDY, A. V., a local director of Samuel Osborn & Company, Limited, the Sheffield steelmakers ... £5,218

TAYLOR, ERNEST, formerly chief electrical engineer with the Sheepbridge Coal & Iron Company, Limited, Chesterfield (Derbyshire) £10,643

'Good Mornings' begin with 1,500 tons of very special steel

F. H. Happold, distinguished industrial journalist, finds a story behind his morning shave

A RAZOR BLADE weighs one-fortieth of an ounce. It is 4 to 5 thousandths of an inch thick.

Yet all the razor blades made in a year by the Gillette factory on the Great West Road, Middlesex, use up over 1,500 *tons* of very special steel strip – nearly 50,000 miles of it! Laid one on top of another, a year's output of blades would make a stack 25 times the height of Mount Everest!

Automatic machinery – covering acres of floor – punches, hardens, tempers, lacquers, prints, grinds, strops and hones the blades all day long. And the steel for this rapid continuous production must be as flawless as the finished blade. It must be absolutely uniform.

F. H. HAPPOLD *For most of his working life F. H. Happold has been a journalist writing mainly on economic, industrial and financial subjects.*

He has studied the British industrial scene from almost every angle over 25 years, and believes he recognises outstanding business efficiency when he comes across it.

At one time the supply of this special razor blade steel came from abroad. But a Stocksbridge steel firm tackled the job of producing it and quickly became master of the intricate technique.

NOW IT'S EARNING DOLLARS

Mr. J. F. Kayser, hard-headed North country Gillette metallurgist, was emphatic: "There's no better razor blade steel in the world than the special steel made in Britain."

So good is the British product that even in America the use of British razor blade steel is increasing, thus adding to our dollar earnings.

How was it done? In terms of plant, it meant brand new electric furnaces, rolling mills, instruments and so on, with new buildings to house them. It meant a major research effort. Above all, it called for the closest collaboration between experienced steelmakers and the experts in razor blade manufacture.

NOT JUST RAZOR BLADES . . .

The morning shave is but one of the thousands of ways in which special steels enter our daily lives. We use them in vacuum cleaners, washing machines, typewriters, motor cars, hair clips, needles and scissors – and a host of other everyday objects. Each one has probably called on the specialised knowledge and devotion of teams of technologists and skilled workers in both the steelmaking and manufacturing firms.

Britain needs the accumulated wisdom and diverse abilities of every one of her three hundred and more steel companies. Without their ready, informal co-operation with steel users, industrial progress would grind to a halt.

This personal report was invited by the British Iron & Steel Federation, which believes that everyone in Britain should know the facts about steel and about the men who make it.

Book Reviews

Selected Methods of Analysis of Foundry Materials. Part 1: Pig Iron and Cast Iron. Published by the British Cast Iron Research Association, Alvechurch, Birmingham, 1959; price 12s. 6d. to members; 17s. 6d. to non-members; $2.50 in the dollar area.

The BCIRA methods of analysis sub-committee was initiated in 1950, under the chairmanship of Mr. N. L. Evans, and since then a tremendous volume of co-operative experimental work has been carried out by its members. The question arose of the most suitable method of presenting this work to the chemists who have to carry out the various procedures. How could the methods be made most readily available to the man at the bench? After much discussion it was decided to publish a laboratory manual in simple and inexpensive form. The present work is the first part of the manual and deals with the sampling and analysis of pig- and cast-irons for carbon, silicon, manganese, sulphur, phosphorus, nickel, chromium, molybdenum, copper, titanium and vanadium. Sections on spectrophotometric methods, laboratory equipment, apparatus and reagents and laboratory techniques are also included.

In order to make the manual as concise as possible and suitable for use at the bench, the subject matter has been restricted to the practical details of each method. The emphasis is on the choice of methods which will give reliable results under routine conditions rather than on reference methods, and all the methods selected have been exhaustively investigated by the methods of analysis sub-committee.

The book is attractively bound in a plastic cover which is resistant to acids, alkalis and the more common organic solvents. For the iron-founding laboratory, this book is nothing less than an essential. Using British standards for check purposes samples and following the methods detailed in this book, there is no reason why the isolated chemist should not produce results of an exceedingly reliable character.

Economics of Nuclear Power—Volume 2 of Series VIII of Progress in Nuclear Energy. Published by Pergammon Press, Limited, 4 and 5, Fitzroy Square, London, W.1; price £5 5s. 0d.

This volume constitutes part of the edited proceedings of the 2nd International Conference on the Peaceful Uses of Atomic Energy held in Geneva in 1958. The book is divided into four parts, *viz.*:—World Demand for Nuclear Energy (54 pages), Nuclear Fuel Supply and Cost (51 pages), Generation of Nuclear Energy (159 pages), and Nuclear Power Programmes (134 pages).

Of special interest to engineers are Parts 3 and 4 which include accounts of plans for nuclear-power development in the United Kingdom, the United States of America, Canada, the USSR, Italy, France, Japan, India and Poland. The effect of reactor-design on costs is the subject of a sub-chapter.

Of importance, too, is the first part in which there are two papers on the Economic Setting for Nuclear Power and Heat Development, and the Need for Atomic Energy in the Under-developed Countries. The volume includes a subject index, and the book is well printed and fully illustrated.

This work is a most authoritative survey, and well worthy of detailed study by those wishing to acquaint themselves with up-to-date economic aspects of nuclear energy.

J. E. GARSIDE.

Publications Received

Cost of Labour Turnover. A Report from the British Institute of Management, 80, Fetter Lane, London, E.C.4; price 17s. 6d.

This booklet makes a contribution to the knowledge of the cost of replacing men leaving the services of a company. This cost turns out to be much higher than a superficial survey would reveal. It is a figure which never appears in financial accounts. Yet, Lord Verulam in a foreword to the publication suggests that labour replacements cost the country many millions a year. In works parlance, he suggests that a job number be allocated to embrace such costs. However, proper accounting would not be easy, for if a poor type leaves and is replaced by a better man a hidden credit is established. Some at least of the labour turnover in a business is often due to a desire to improve the calibre of the staff—a not unimportant factor. Rightly the Committee draw attention to the cost of advertising for staff, but again some of these announcements carry a good deal of publicity for the firm, which again could result in hidden credit. The general case for ascertaining the cost of labour turnover is clearly set out in appendix A, but in the reviewer's opinion it is a little controversial because of the hidden credits referred to. Nevertheless, this does not detract from the interest which the book arouses in the general subject.

1959-60 Prospectus for the Poplar Technical College, Poplar High Street, London, E.14.

This is one of the few colleges in the London area which caters for both patternmaking and foundry practice. Both courses lead up to the City and Guilds intermediate and final examinations. For patternmakers there is an advanced class for those holding the final certificate of the City and Guilds. Details are available on writing to the principal of the College, Mr. P. J. Howard, B.SC., at the above address.

Eyes at Work with Safety and Efficiency. Issued by J. & R. Fleming, Limited, 146, Clerkenwell Road, London, E.C.1.

The objective of this publication is to detail a service the firm has created for combining optically-correct lenses as part and parcel of an industrial goggle, as poor vision can often be a cause of an accident just as much as the omission to wear goggles.

House Organ

Edgar Allen News, July 1959. Published by Edgar Allen & Company, Limited, Imperial Steel Works, Sheffield, 9. The JOURNAL congratulates *Edgar Allen News* on having achieved 40 years of continuous publication, though since the latest issue is numbered 445 there must have been a few blank months. In this issue is reviewed the past history of the magazine and also covered is the opening of a library donated by the company to Sheffield University. The new library, which replaces the one given by the late Mr. Edgar Allen, was opened by Mr. T. S. Eliot, O.M., and his visit to the works on the following day is also described and illustrated.

CLAYTON DEWANDRE COMPANY, LIMITED—Mr. S. E. Willett has retired as a director.

CRITTALL MANUFACTURING COMPANY, LIMITED—Mr. E. J. Peel-Yates has been appointed a director.